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THE

INTERNATIONAL

SUGAR JOURNAL

WITH WHICH IS INCORPORATED

THE SUGAR CANE,

(1869-1898,)

A MONTHLY MAGAZINE,

DEVOTED TO THE INTERESTS OF THE SUGAR INDUSTRY GENERALLY

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INDEX TO VOLUME I.

THE

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☞ All communications to be addressed to Edward Sutton, 24, Seymour Road, Manchester.

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☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

Most of our friends will have read the announcement made in the first two pages of last month's *Sugar Cane* regarding the prospective change in the scope and title of the journal. As we have further sent a copy of that announcement to all subscribers whose names are known to us, it remains here only to remark that the principal aim of the present publication will be to place on record, more fully than we have formerly done, all experiments, discoveries, and inventions relating to the agriculture and manufacture of sugar of every kind, so that this new and somewhat more ambitious undertaking may eventually constitute for all interested a means of reference on such matters, in the same way as *The Sugar Cane* has done in connection with the cane sugar industry for the last thirty years.

Owing to want of space we have been compelled to leave over until next month a portion of our article on the events and occurrences of 1898. Several interesting technical articles are also unavoidably left over for the same reason.

Messrs. Blyth Brothers & Co., Mauritius, give shipments of sugar from 1st August to 25th November, 1898, as 55,100 tons, against 41,709 tons during the corresponding period of last year. Shipments to the United States, mainly low syrups, have been more than five times as large as last year.

Exports from British Guiana, from 1st January to 30th November: Sugar, 89,962 tons; rum, 18,741 puns.; molasses, 3,619 casks; cocoa, 52,401 lbs.; against 80,341 tons; 18,577 puns.; 6,106 casks; and 89,415 lbs. respectively, for the like period last year.

We are informed that the business of the old-established machinery firm well known as the "Anciens Etablissements Cail" has been incorporated with the "Société Française de Constructions Mécaniques." The Paris address remains as before, 12, Rue de Londres, the management will be located at Douai, Rue de Lille, No. 28, while the much enlarged works at Denain and Douai place the firm in a position to execute with facility the largest possible contracts for sugar and other machinery.

According to a French authority, about 30 new Russian factories are in course of erection, about three-fourths of which will be at work by 1899-1900. Of the whole number, five are being erected by a firm in Prague; seven by Russian firms; three by the Sangerhäuser Maschinenfabrik; two by the Maschinenfabrik Grevenbroich; and one each by the Sudenburger Maschinenfabrik, the Braunschweigische Maschinenbau-Anstalt, and the Compagnie Fives-Lille.

CUBAN REPORT.

Statement of Exports, Stocks, and Total Production of Sugar, 1896-97 and 1897-98.

(Tons of 2,240lbs.)	1896-97. Tons.		1897-98. Tons.
Exports	204,123	..	251,098
Stocks	1,888	..	11,360
	206,011		262,458
Local Consumption (12 months)	38,000	..	44,600
	244,011		307,058
Stocks on the 1st January (old crop)	31,960	..	1,515
Total Production for 12 months	212,051	..	305,543

Distribution of Exports.

	1896-97. Tons.		1897-98. Tons.
United States (4 Ports north of Hatteras)	202,703	..	244,499
Spain	1,337	..	6,599
Nassau	83	..	..
	204,123		251,098

Joaquin Guma,
Corredor Colegiado de Comercio.

Havana, 30th November, 1898.

1898.

The year just closed has by no means been wanting in rather special features and incidents, and the eventual developments of one or two of these, which rather intimately affect the future of the world's sugar market, will be awaited with some degree of anxiety. It is satisfactory, however, to be able to record a more healthy situation of matters as regards the relations between demand and supply, and an increase of steadiness in all markets in proportion as all concerned began to recognise the greater soundness of the statistical position of sugar.

The year opened with some dulness; a portion of the advance in prices which had been established in December, 1897, was lost, and it was not until the beginning of February that a certain amount of animation, due to the French and German official figures of stocks being lower than had been anticipated, became manifest. This proved only temporary; a feeling of unsettlement respecting the outcome of the existing political complications produced dulness and want of enterprise, which again gave way in April to greater firmness and activity, due primarily to the almost certain eventuality of war between the United States and Spain, which it was thought would result in the probable locking up of a considerable quantity of sugar in Cuba, and the American refiners being consequently compelled to enter the European market as purchasers. The outbreak of the war, with the ultimate stoppage of supplies from Cuba and the Philippines, together with a partial failure of crops in Southern India, brought about a period of still greater activity, though June witnessed a slight relapse from the advance in prices which had been established in the previous month. American buyers ceased to operate, and all parties apparently preferred to wait until the probable outcome of the Hispano-American war and also of the Brussels Conference should become more clearly evident. All this time the statistical position was distinctly improving, and this fact undoubtedly exercised a strong influence in preventing any undue depression in prices. For various reasons, August brought a distinct improvement, and an advance in prices of all sugars set in and continued, with but slight fluctuations, to the end of November. The general consensus of statisticians as to the probability of a smaller beet crop than that of the season just closed, the likelihood that the December-March crop in Cuba would not exceed the figures of 1897-98, and the conviction, now becoming general, of the satisfactory nature of the statistical position, fully

accounted for this improvement. In the middle of December an unexpected increase in the estimated figures of the European beet crops resulted in a rather smart fall in prices of beet sugar both for present and future deliveries. The effect of this complete surprise to all concerned will probably pass over into the new year.

One thing which seems difficult to explain is the persistent caution which has characterised the movements of buyers both in this country and in the United States, the result of this attitude being that there have been no violent fluctuations of any kind during the year under review, although there have not been wanting occasions when speculators might have been expected to operate. The general unsettled state of European and American politics must be credited with some of the want of confidence and even apathy shown. The comparatively even tenour of the course of the market has also been largely due to the ease with which the different factors in the necessary calculations could be estimated, but this must not be expected to continue. We are entering on a period of uncertainty as to the future, and it may be anticipated that speculators, who prefer to fish in troubled waters, having more chance afforded them for their operations, will again play a more important part.

One of the special events of the year, the assembling at Brussels of the Ninth Sugar Congress to consider once more the question of the international abolition of sugar bounties, has resulted in disappointment. It may be considered that its ultimate practical failure was assured. The stumbling-block was again France, which managed to obtain the concurrence of Russia in declining to allow any discussion of the large indirect bounties conferred by their systems of internal fiscal legislation. But the British government, had they simply authorised their delegates to declare that this country was prepared, in the event of the failure of any satisfactory arrangement for abolition of bounties, to levy countervailing duties on all sugars that enjoyed a bounty, direct or indirect, might have solved the whole problem; the Conference would have very quickly adjourned, and the representatives would have returned to help their respective governments to consider how they could best face the new situation. England held the key of the position, and to this inexplicable unwillingness to apply the only remedy must be attributed the final collapse of the negotiations. Some hopes are still cherished of an ultimate outcome of the well-meant efforts of the Belgian government, which it is asserted are being continued, but it is to be feared that

for the present the net result of the active exertions of the representatives of our Colonial producers and the British refiners must be found in the admission, distinctly made by responsible members of our government, that countervailing duties are not an infringement of the principle of Free Trade as laid down by its founders, along with the hope, which this admission encourages, that the responsible advisers of the Queen may yet be brought to act on their convictions. Meantime, the further discussion of the question of the abolition of sugar bounties must for the time be regarded as once more relegated to the Greek Kalends. The activity displayed by the many prominent advocates of the suppression of these bounties, and the full discussion of matters which has been carried on in the columns of *The Times*, * and many other journals has, however, undoubtedly resulted in enormously strengthening the conviction that bounties are an evil in themselves, and injurious to the very industry they are intended to foster. Even a large number of thick and thin Free Traders are now willing to admit that everything, except one thing, viz.: the application of the one effectual remedy of countervailing duties, should be done to get rid of them. This remedy they (*plus loyal que la loi*), persist in regarding as calling in Satan to cast out Beelzebub.

Although the Brussels Conference must be allowed to have occupied a notable place in the occurrences of the past twelve months, inasmuch as it has at least served to define more clearly the position and to bring into marked prominence the fact that Great Britain at present holds the key of that position, yet it has unquestionably been the United States which have provided the great sensation of the year as regards sugar matters. And as time goes on it will become more and more *clearly evident that the Great Republic is henceforward the principal* factor in all considerations regarding the eventualities and future of the world's sugar market.

For some time past it had been clear that the support more or less openly given to the Cuban insurgents by the United States must sooner or later lead to hostilities with Spain, and in April last, the expected war broke out and quickly resulted in victory for the Americans. Proposals of peace were made on behalf of Spain towards the end of July. The negotiations have terminated in the cession and annexation of Porto Rico, the cession of the Philippine Islands, and the renunciation by Spain of all claims to sovereignty over Cuba, and of all rights in that island. The form of government which will

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* See *Sugar Cane* for September, October, November and December, 1898.

ultimately be established in the territories thus acquired is as yet uncertain, but the matter is of no small importance to the American cane and beet sugar industries, as the question whether—and if so, when—the large sugar production of these possessions will be admitted into the United States duty free, or possibly with a preferential duty, is to the home sugar planters and beet growers and manufacturers a most serious one, while there is the further question whether or no in the event of these countries being, as is possible, held as "Territories," export duties will be levied in them for purposes of internal revenue.

Another occurrence of less eventual world-wide importance, but which possesses special interest of its own in the consideration of matters on the other side of the Atlantic, is the annexation of the Hawaiian Islands, which—in spite of the protestations of a not inconsiderable party, who were of opinion that the United States had no mission to annex or colonise, and that to do so was a violation of the constitution, at all events as defined in the long accepted Monroe Doctrine—was at last formally completed in July last. It may here be remarked that the labour question may even yet constitute a difficulty that may operate in the direction of retarding the development of the sugar industry in these islands. Competent men are not wanting who declare that the contract system of labour, which involves a penal clause, and on which the continued prosperity of the Hawaiian Islands undoubtedly depends, cannot be tolerated in the United States or any of its dependencies. It is to be expected, however, that the gnat of contract-labour will ultimately follow the camel of annexation, as the important interests concerned may be relied on to work this out as effectually as they have done in the case of the evasion of the law against the combinations known as "Trusts." There was a rumour current that in view of the changed situation, the American Sugar Refining Co. was intending to erect a large refinery on one of the islands, but the arrangement eventually come to has resulted in the Company contracting for more than two-thirds of the entire crop for a series of years, the remainder being reserved for the refinery at Crockett, (California), owned by the Hawaiian planters and their friends. The effect of the change has been to send up the shares of the Hawaiian companies, who are expecting to make large profits in the future; it is to be hoped that the "boom" will not be carried so far as to end in disaster.

The fact that, to our mind, stands out most boldly from the changed state of matters in connection with the transfer to the United States

of all these wonderfully productive sugar growing countries is this, that we shall have to consider, and that at no distant date, whether in the long run the hitherto victorious beet sugar industry, with or without bounties, can continue to retain its predominance in face of the results which will follow the introduction of far better implements and apparatus and the most modern improved processes which is certain to take place in Cuba, Porto Rico, and the Philippines, and to be more extensively adopted than hitherto in the Hawaiian Islands. That we are confronted with probable developments of a possibly somewhat unexpected character, admits of no doubt whatever. And it will be well for all concerned to endeavour to weigh carefully the chances as to the precise nature of these developments, and how far circumstances may conspire to favour or retard them. As far as the matters above alluded to concern the United States alone, those interested in the production and distribution of sugar there might well be left to look after themselves in a country where legislation is so easily brought to bear on questions of commercial importance and interest, though we think both the cane planters of the South and the beet growers and manufacturers of other portions of the Union—the latter very especially—have legitimate cause of complaint in connection with the sudden addition of the large duty-free supplies from Hawaii and (probably) Porto Rico, leaving aside for the moment the possibilities that may result from the acquisition of the Philippine islands and eventually of Cuba. At a meeting of the Louisiana Sugar Planters' Association, called for the 8th December last, a couple of papers—one by Dr. H. W. Wiley, of the U.S. Department of Agriculture, the other by Mr. Henry A. Brown, of Westport Point (Mass.), well known to our readers as an accomplished sugar expert and a regular contributor to the *Sugar Cane* for many years—were to have been read and discussed, but the meeting was unavoidably postponed. Fortunately for our present purpose, it was decided to publish these two valuable and instructive papers in *The Louisiana Planter*, the official organ of the Association and from them (to be found in the issue of *The Planter* dated December 10th, on "The Probable Effect of the Annexation of Spanish Colonies on the Sugar Industry of the United States") we propose to quote the summary conclusions arrived at by each of the very competent writers.

Dr. Wiley thinks that for some years, at any rate, Cuban sugars will pay duty, and his figures of production and consumption lead him to the conviction that the proportion of sugar imports to consumption

will not be materially increased by the addition of the duty free imports from the other new acquisitions. The conclusions at which he arrives are:—

"That the annexation of the Hawaiian Islands, Porto Rico, and the Philippines will have no directly damaging effect on the cane and beet sugar industry of the United States.—That an American protectorate over Cuba, not involving the free admission of Cuban sugar, will result in the practical cessation of beet sugar imports from Europe, but will not adversely affect the sugar industry in this country.—That the possibility of an American protectorate in Cuba resulting eventually in Cuban annexation or in a customs union will deter capital from investment in sugar factories in this country, and thus indirectly the results of the Spanish war will become a check to the expansion of the sugar industry in the United States. For this reason it is not to be expected that there will be any marked increase in sugar production in this country for several years to come.—That the final annexation of Cuba or the foundation of a customs union with her would be a severe, if not fatal, blow to the existing sugar industry in the United States, and that it is doubtful if it could continue to survive. The rapid increase in population during the next hundred years might, however, secure the revival of the industry within the present limits of the United States, though, this is a consideration too remote for practical application at the present time."

Mr. Henry Brown lays special stress on the point that, neither Hawaii, Porto Rico, nor the Philippine Islands being States of the Union according to the Constitution of the United States, but only dependencies or "Territories," Congress has power to levy import and export taxes and duties for the support of the government of such territories, and he expresses the opinion—

"That if Congress fails to levy exports taxes upon the sugars sent to us from the Hawaiian Islands, the Philippine Islands, and Porto Rico, it will not only fail to make proper provision for the support of our governments in those islands, by making them self-supporting as far as possible, but it will neglect to protect home sugar producing industries, by means that take nothing from the people or the Treasury of the United States, but actually relieve both people and Treasury, while protecting the great and growing sugar producing industries of the United States. Such a blunder of Congress would injure but not destroy our sugar industries by any means. American enterprise will conquer even such neglect of a great American industry."

As regards the increase in production which he admits is likely to take place under the new conditions, he does not think that the American home industries have at present much to fear from the acquisition of the Philippines, Porto Rico, or Cuba (partly because he assumes that export duties will be levied in those countries), but he does think that the impetus given to the Hawaiian production will render the Hawaiian Islands a dangerous competitor unless an export duty is levied on their sugars. He says:—

"Hawaii will prove to be a powerful competitor by reason of her enormous capacity of sugar production per acre, and the fact that, with the 'Sugar Trust' to back planters in Hawaii in order to control Hawaiian sugars, the acreage may be increased or even doubled by employing irrigation leads to the conclusion that instead of the 223,110 tons of Hawaiian sugars sent us in the year ended June 30th, 1898; we must expect 300,000 or more tons per annum, which may be increased to 400,000 or more tons, all of which is likely to be controlled by the 'Sugar Trust,' and used to govern this market so far as it will be possible for that company to do so. Let no one imagine that the American Sugar Refining Company intends to handle the Hawaiian crop for fun or love, or to keep

up the price of sugar when it suits its purpose to cut prices. The effect of greatly increased imports of Hawaiian sugar, sure to come, and of the handling thereof by the 'Sugar Trust' will be injurious to the sugar industry of the United States, unless the cost of such sugars is increased by levying on export duty thereon in the country of production. This is sure to be opposed by the above-named company, but should obtain nevertheless."

Mr. Brown also calls particular attention to the increased cost of production which will attend the eventual manufacturing of an improved class of sugar in the Philippines and in Cuba. He sums up his views on the whole subject as follows :—

"Briefly summarised, 'The Probable Effect of the Annexation of Spanish Colonies upon the Sugar Industries of the United States' will not be by any means destructive unless American producers choose to sit down and lose their grip, but there will be no walk over for our sugar industry in the future, and in fact there has been none in the past. If the sugars of the Philippines and Porto Rico are sent to this country free of any export tax, as well as free of duty on arrival, the effect must be to some extent injurious, but not destructive of the home industry by any means; there is far more to be feared from Hawaiian sugars and their handling by the American Sugar Refining Company, hence an export tax on Hawaiian Sugars sent to the Unined States is imperatively required as a necessary protection for American sugar producing industries, quite as much as tariff protection is required for refined sugars by the American Sugar Refining Company, and quite as much as a tariff or import duty is required either for protection or revenue, on importations of sugar or any other article of commerce entered for consumption in the United States in competition with home producing industries of this country.

"Consumption of sugar in the United States has nearly doubled per head and has more than doubled in quantity during the past eighteen years ending June 30th, 1898. The increase in consumption has been more rapid than the increase of home production. The increased influx of duty free Hawaiian sugars has been readily absorbed, and large quantities of European beet sugar have been used to meet our demands for consumption. The cane sugars from Porto Rico and the Philippines will have little effect on home production in view of increased consumption in the United States. With all other foreign sugars continued dutiable, and an export duty or tax levied on sugars from the Territory of Hawaii and the Spanish Islands in our possession, the sugar industry of the United States, backed by American ability, capital, energy and skill can and will compete successfully with the new sugar producing dependencies or territories. I claim that the sugar producers in the United States have a right to the protection indicated, and that Congress should grant it. If the right must be fought for, then fight for it in Congress until such adequate protection is secured. All consumers of sugar in the United States are deeply interested in protecting the American sugar industry, lest they fall into the hands of foreign sugar producers, and be quickly forced to pay far higher prices for sugar, which has become an article of food necessity to every family and individual in the United States."

It will be seen that these two very capable authorities agree tolerably closely in considering that under the most favourable susposition with regard to the political and fiscal arrangements, the interests of the American sugar industry will suffer indirectly, but under the supposition of the establishment of a customs union with Cuba or the annexation of that island, they will receive a fatal blow. Also that anyway the importation of European beet sugar will practically cease. This means that the amount of the beet sugar which is already flooding the British markets, and invading those of India, Japan, and China, will be largely increased, in other words, that the struggle between

beet and cane sugar will be further intensified, and that the entire sugar industry of the world will again suffer from over-production, and the ever recurring crises will become more frequent, more fatal, and more far reaching in their effects. The British Colonies, more particularly those of British Guiana, Mauritius, and the West Indies, will thus be placed in a more alarming position than ever, while the advantages which the first and last of these are now enjoying from the operation of the new American countervailing duties, bid fair to disappear in a very short period of time.

The competition between the American Sugar Refining Company and the independent refineries, more especially the large Arbuckle and Doscher Refineries lately established, is undoubtedly a matter of considerable interest, but previous experience of similar occurrences indicates that, in spite of occasional rumours of compromise which have not been verified, the struggle may last for one, two, or even three years. A settlement of a similar nature to the one arrived at on the last occasion, viz.: the absorption of the independent refineries by the "Trust," is hardly so probable in the present case. Meanwhile, the United States consumer seems on the whole to be profiting by the competition. The saying of one of the wittiest American writers that "all things are possible in a republic" should not be forgotten in connection with this matter.

As regards the West Indies and British Guiana, in face of the express declaration of all the experienced men examined by the Royal Commission, and of all the best authorities on the subject in this country, and also of Mr. Chamberlain's practical admission to the effect that countervailing duties constitute the only possible salvation of the sugar industry in those parts, the British Government has confined itself to half measures of grants in aid and loans which, however liberal some appear to think them, are absolutely of no effect as a permanent relief. And as far as the grants lately made to St. Vincent, Barbados, &c., are concerned these are only barely sufficient, if indeed they are that, to make good the disasters caused by the fearful hurricane of the 11th September. A summary of the Government measures, as drawn up by the West India Committee, will be found in *The Sugar Cane* for last September (page 450), and the opinion held by those best qualified to judge in regard to the efficacy of these measures may be gathered from the numerous articles and reproductions of correspondence on the subject which have appeared in nearly every issue of *The Sugar Cane* for the past nine or

ten months. The action taken by the Government in establishing an Imperial Agricultural Department for the West Indies and British Guiana under the personal supervision and control of Dr. Morris, C.M.G., &c., late Assistant Director of the Royal Gardens at Kew, formerly resident in an official capacity in that quarter of the globe, must not be overlooked, and it is quite possible that if such a proceeding had been adopted years ago something much more effectual might have resulted than can now be looked for. But this measure is quite powerless to stem the tide of adversity or conjure the crisis which threatens the existence of the staple industry. While the grass is growing the cow is starving, and desirable as the establishment and development of "minor industries" and the improvement of the sugar cane undoubtedly are, these can only be the work of time, while the need of a remedy is urgent, immediate, and imperative. The effectual remedy is only to be found in the adoption, by the government of the United Kingdom, of countervailing duties on all sugars receiving bounties, direct or indirect, and we do not hesitate to assert that this is the only means of salvation for the world's sugar industry, the only measure that can bring about for it the conditions of a permanently sound and prosperous existence. We may just allude, in passing, to the proposition for the incorporation of the West Indies with Canada, which certainly has a more practical foundation than the wild rumours of a desire for annexation to the United States. The results of the Hispano-American war have, it is to be hoped, effectually disposed of any such ideas as the latter, if indeed they ever existed in the minds of serious persons; the weak point, however, in the proposition for incorporation with Canada is, that the present rate of consumption in that country would only dispose of about some two-thirds of the West Indian production, still we shall not be surprised if something definite should come out of the proposal.

Turning to Mauritius—we find a very similar state of things to that which has for a long time obtained in the West Indies, though in this case the evil is of more recent origin. Some two years ago, the quantity of Austrian sugar reaching India began to affect very seriously the prices obtainable in that country for the Mauritian product, and measures were at once taken by those interested to bring the question under the notice of the British Government in connection with the report of the West India Commission. The importation of Austrian sugar into India has gone on increasing, and has very materially damaged the interests of the Mauritian sugar planters,

for whom that country has long formed the great and most natural market for their production. The sugar industry in the island has long been in an unsatisfactory condition, the yield obtained by the machinery in use there being much below what could be got by superior apparatus. Some help was obtained by the reduction of the expenses consequent on the holding of large estates, through the parcelling out of land among small planters, mostly Indians, who work very economically, so that at present probably one-fifth of the whole area under cane cultivation is either owned by these small cultivators, or worked by them in shares with the owners, the cane being crushed at the factories of the original proprietors. But this was quite insufficient to remedy the situation, brought about mainly by the competition of the bounty-fed sugar, and applications for an Imperial guarantee for a loan, and also for a direct loan, made to the Colonial Office, were unfavourably received, and on being renewed, were again unsuccessful. Active measures have now been taken in conjunction with those in India who were so seriously affected by the competition of the European sugars, to bring the matter fully under the notice of both the Queen and the Governor-General of India. At a meeting of the Mauritius Chamber of Agriculture, some two months back, petitions to Her Majesty and to the Viceroy of India, were adopted, after eloquent and impressive speeches by Mr. Quintin Hogg and Sir Virgile Naz, K.C.M.G., which went to the root of the matter. These petitions received some 7,000 signatures, and were forwarded by the Governor, who gave them the sanction of his support. The principal feature of the petition to the Queen was the request for the enactment of countervailing duties on bounty-fed sugars imported into the United Kingdom and India, or the exclusion of such sugars from those markets, while the one to the Viceroy laid special stress on the close connection of the Mauritius with India, and the fact that nearly three-fourths of the population of the Island are either native born Indians or immediate descendants of such, and that the request for countervailing duties is supported by the Indian Chamber of Commerce and the Chamber of Agriculture of Upper India. The crop now being taken off will be one of the largest ever grown in Mauritius.

As regards the importation of beet sugar into India, it is stated that it has grown from 246 tons in 1895-96 to 47,287 tons in 1897-98, and the representatives of the Indian sugar industry, recognising the imminence of the danger, which has already resulted in the closing of several refineries in Bengal, have made urgent representations to the

Indian Government and demanded that the question of imposing countervailing duties should be considered without delay. For some time efforts have been made under government and local supervision for the improvement of the agricultural and manufacturing processes in the sugar producing districts, but of what avail can these be if the artificially stimulated European industry is to be allowed to swamp the home production. It is indeed a very discreditable reflection on the economical and fiscal ability of the possessors of India and their governments, that the very country which was probably the original home of the sugar cane and the seat of the first production of sugar should be threatened with the extinction of that production, which can be historically shown to have existed for over two thousand years.

The sugar industry in the Australasian Colonies, although prosperous enough from the point of view of increasing output as regards Queensland, is not in what can be called a satisfactory position. As far as New South Wales is concerned, the industry must be regarded as declining, owing to the progressive reduction of the protective duty on imported sugars. The danger which, in our opinion, the sugar planters and manufacturers of Australia have to face lies in the fact of their production exceeding the home demand, and the consequent necessity for exporting some portion and thus being compelled to meet the competition of the bounty-fed beet sugars of Europe, which indeed have already invaded some of their own markets. Then again there is the fact that the operation of the Sugar-Works Guaranatee Act, which has rendered possible the erection of several large central factories, cannot be considered a success. Much sugar has been produced, the net cost of production has been considerably reduced, many cane farmers have made a good profit out of the new cultivation which they have been able to take up, but the mills have mostly failed to to meet their obligations for repayment, and a number have not even paid the interest on the loans which enabled them to be started. It is possible, indeed probable, that the Queenslanders will be able to deal with this matter, and it must be allowed that they are actively alive to the adoption of new processes for obtaining increased yield and are continually and intelligently studying the problems connected with cultivation and manufacture. But the matter of over-production we regard as very serious, and it is interesting to hear that offers of Queensland sugar are being made in the United States, though there is a possibility that the American Treasury officials may consider that these products are subject to countervailing duties, and

so the excess production may have to be "slaughtered" in the London markets. Queensland, it may be remarked, is going in for coffee growing. At the Richmond River Experiment Farm, (N.S.W.), experiments are being made with varieties of cane obtained from New Guinea, in the hope, which appears likely to be fulfilled, of obtaining some rich and vigorous sorts which would resist the diseases of rust and "gumming."

From Egypt the reports indicate general prosperity and successful progress. The factories had to contend with defective cane owing to the occurrence of frosts, nevertheless the extraction was so good, and the economical treatment so much improved that the defect in the canes was more than made good, and a capital profit realised. The adoption, at Rodah, of a system of thorough washing or lixiviation of the bagasse, has been thoroughly successful. A full account of this system will be found in *The Sugar Cane* for May (pp. 241-247) and November (pp. 569-571). There are some eighteeen factories and refineries now in operation, nine of which belong to the Daira Sanieh. At one of the factories belonging to the Société Générale d'Egypte the Say-Gramme process of electrolysis in clarification is being tried.

In Natal matters have gone more to the satisfaction of the planters than last season, and in spite of some losses from drought it is said that the crop will reach 25,000 tons. To make head against the ravages of the locusts, which lately caused such fearful destruction, a cane called the Yuba has been largely adopted, which is said to have the advantages of being locust proof and frost proof and of ratooning freely, keeping down the weeds and requiring little manure. Its disadvantages are that it is difficult to crush and requires special treatment in the manufacture.

But little information is available as to the Brazilian sugar industry. Owing to many of the factories being fitted with poor and antiquated machinery, there is a decline in production, though statistics are little reliable. It is probable that only some 30,000 tons will be exported, as the home consumption absorbs nearly 80 per cent. of the production.

Up to very lately the sugar industry in Venezeula was in a most primitive condition, the most antiquated processes only being in use. One of the planters in that country has just had a small factory erected by a French engineer, with results which will certainly shortly revolutionise the industry, which hitherto has only obtained on an average 3 per cent. of sugar on the weight of canes, the product being coarse and unsightly.

The Mexican sugar industry is steadily advancing, the new machinery set up of late years, much of it being from Scotland, has worked very satisfactorily, but the production is as yet insufficient for the requirements of the country. With the enterprise and activity now being displayed, particularly in connection with the employment of American and British capital, Mexico, undoubtedly most favourably endowed for the growth of rich and abundant cane crops, will quickly overtake her home demand and increase her exports to the United States and Great Britain, which at present are quite small, while the import is more than double the export.

The Argentine Republic, which has been suffering from the large over-production of sugar in 1895, is now recovering from the crisis, the recuperative process being assisted by the small crop of 1897-98, the yield having been poor owing to much damage by frost.

From Java we have had nothing but favourable reports. The crop finally worked up by the middle of October turned out the largest and finest hitherto known. The canes were large and heavy, and the saccharine content above the average. The season was somewhat wet, and the roads were frequently impracticable for the buffalo carts. The crop is finally estimated at 711,500 tons. The new crop is doing well, but cannot be expected to attain the dimensions of the one just taken off.

The number of factories is steadily diminishing, not because of any decrease in the area planted, which is estimated this year at over 202,000 acres, but because of the policy which is being pursued of adding small estates to others in order to bring down the general expenses. By this means, and by careful cultivation, and the adoption of improved machinery and processes, together with chemical control, the planters have been successful in reducing the cost of working every year, and in thus meeting the competition of the beet sugar. Crystallisation in movement has been especially successful, and we learn that all the first sugar is obtained in one operation, leaving nothing in the molasses, but a very low class second sugar, the so-called "sack sugar," which cannot be centrifugalled. The services rendered to the Java industry by the chemical experts cannot be overestimated, one has only to look through the pages of the organ of the planters, the *Archief voor de Java-Suikerindustrie*, to recognise the laborious, intelligent, and painstaking work which they are doing in every direction that can affect the well-being of the plant, its cultivation, and the entire process of manufacture. We hear that the Ranson process has been tried in three factories, but it was not found to be adapted for cane sugar manufacture, at any rate in Java.

In Japan, there are now two refineries in full operation under European superintendence. The consumption in that country is far too large for the home production to supply, and has for years been steadily increasing. On the first of January this year, the new import duties came into force; under these the duty on raw sugar is raised from about 2½d. to 4¼d. per cwt., while the old rate for refined, about 5d. is raised to 2s. 6¾d. for 15 to 20 D.S., and to 3s. 0¾d. for all above 20 D.S. The imports in 1897 were 192,000 tons, considerably under half the quantity being raw, and continued to increase in 1898, but those of refined will now fall off largely, owing to the new tariff.

(To be continued.)

THE MANUFACTURE OF GLUCOSE.

By Sigmund Stein,

Manager, Messrs. Crosfield, Barrow & Co., Sugar Refiners, Liverpool.

Glucose (grape sugar, dextrose, starch sugar) $C_6H_{12}O_6$ is found in a great many plants, very often in company with levulose. Anhydrous glucose ($C_6H_{12}O_6$) forms hard, non-hygroscopic fine needles, which have a melting point of 146°. The specific gravity of anhydrous glucose is 1·3861. The specific gravity of the saturated water solution at 15° C. is 1·221. Glucose dissolves easily in water. In 100 parts of water at 15° C., 81·68 $C_6H_{12}O_6$ dissolve. Glucose is optically active, and turns the ray to the right. The rotation dispersion of glucose and that of quartz are nearly the same, viz:—$\frac{G}{Q}$ = about 2·48, it is therefore possible to determine glucose with the polarimeter. If the 100° point of the scale corresponds with a solution of 26·048 gr. cane sugar in 100 cc. of water, it is necessary to dissolve 32·683 gr. glucose in 100 cc. water, to obtain, with a 200 mm. tube, the same diversion. Each degree in the scale is equal to 0·3268 gr. glucose (anhydrous) in 100 cc. solution.

The name "glucose" is from a Greek word meaning "sweet."

The glucose ($C_6H_{12}O_6$) of commerce is a mixture of dextrose, maltose, and dextrine (starch gum).

Glucose was discovered in grapes by Lowitz and Proust in 1792, and Kirchhoff prepared dextrose from starch in the year 1811. Braconnet made glucose from cellulose, and Dubrunfaut detected "maltose" in 1847, in the product resulting from the action of malt on starch.

Starch sugar has a sweetening power of about one-half that of cane sugar.

Honey often contains as much as 70% of glucose, and the juice of the sugar cane, sorghum, melons, &c., also contains glucose.

The commercial term "glucose" is a rather elastic one, including not only the glucose of chemistry, *i.e.*, pure grape sugar, but also several more or less inverted products of starch. The manufacture of glucose is increasing year by year, and is chiefly carried on in the United States and on the continent of Europe. In the United States, where over £5,000,000 are invested in various glucose works, it is made from wheat, rice, and maize; on the Continent chiefly from potatoes, but it can be made from all substances containing starch. In the United States over 100,000 bushels of wheat are daily used for making glucose.

Glucose is used as a substitute for cane sugar in the manufacture of confectionery, jam, candy, jellies, wine, and beer, as well as for mixing with refinery syrups for consumption. Of late, English brewers have favoured the use of glucose, and use it along with malt, and they say they obtain from this mixture a malt liquor of a more permanent character than when brewing with malt alone. It is legal to use 28lbs. of glucose to each bushel of malt.

In this article I propose to treat only on the manufacture of glucose from corn, and reserve for another paper the manufacture of glucose from other starchy raw materials.

Corn Glucose.

Corn consists of starch, gluten, oil, and bran, but for making glucose starch only is necessary, so that the other three constituents must be got rid of. In dealing with the manufacture of glucose proper, I shall describe technically the different processes and operations under their names as used in the glucose factory. In former times a very simple process was used for making glucose. Corn was steeped in hot water for a short time, and at length became slightly putrid. The corn was next ground and washed in sieves. The "raw starch" ran through these sieves, and afterwards passed over long inclined "starch tables." The starch then settled down, and was afterwards dried. The part which passed over the sieve was used as cattle food. The wash-water was either sold or else sent into the river, and in the latter case it caused putrefaction, and was a great nuisance. All the valuable by-products were lost by this old rudimentary process. Nowadays a more elaborate and scientific process is employed, a description of which follows.

Analysis of Wheat.

Starch	69·11
Fibre	1·59
Gluten	10·35
Oil (fat)	4·39
Ash	1·51
Moisture	13·05
Total	100

The present manufacture of glucose consists of the following processes :—

1. Steeping.

After the shelled corn is freed from any adherent foreign substances by cleaning machines and air-blowers, it is steeped. The intention of this process is to harden the corn, so that grinding can be easily performed, and to dissolve the gummy matters. The steeping is done in large wooden vessels holding from 3,000 to 4,000 bushels, which are treated with water of a temperature of about 85° F., at which temperature the water is kept during the whole time of the steeping process. Afterwards, $\frac{3}{10}$% sulphurous acid gas is blown into the vessel to prevent fermentation and souring, until the water is perfectly saturated with this chemical agent. The steeping lasts for about three days. As soon as the corn is sufficiently soft the water is changed and the first wash-water runs away into the sewer. After this process is complete the corn is taken out and passes by an elevator to the second station.

2. Crushing.

This is done as in ordinary mills, either with stones or rollers of two grades, first coarse and afterwards fine, and facilitates the loosening of the germ. After grinding, the corn is submitted to the following process :—

3. Separation of the Germ.

The germ of the corn, containing an oil commercially known as corn oil, forms a most valuable by-product.

The crushed corn is put into a vessel having a mechanical stirrer and containing starchy water. The germ floats on the top because it is lighter than starch, and is carried away through a pipe which terminates a little above the surface of the water in the vessel. The germs are afterwards washed on a sieve, which is kept in motion, where they remain while the starch water passes through.

The germs then go through the next process,

4. Centrifugalling,

which frees them from the adherent water.

5. Drying and Pressing the Germs into Cakes.

The germs are dried in a hot air stove, ground, and pressed into cakes, and in the process an oil runs off, which is known as corn oil. These cakes are imported into England in great quantities under the name of "corncake."

The next process is:—

6. Grinding the Starchy Mass.

After the germ have been separated the starchy mass is ground and mixed with water in a vessel until it assumes a proper consistency, and is then carried by a strong stream on to a system of riddles known as the "shakers."

7. The Shaking Process.

The riddle, size about 9 ft. by 2½ ft., has in its frame a very fine silk sieve, which is inclined at an angle of about 30°, and is continually moving backwards and forwards, and has a continuous stream of water running over it. The fine starchy parts and the gluten pass through the sieve and are by this means separated from the bran, which falls down to the bottom of the inclined sieve. The bran is either packed dry and sold as a dry substance, or sent away in a wet state and used for cattle food.

8. The Separation of the Starch from Gluten.

It is not difficult to separate gluten from starch, as gluten is much the lighter of the two. The mass is run over long inclined tables about 250 feet in length. The starch being the heavier settles down at the upper part, gradually becoming less and less in quantity to the end of the tables, whereas the gluten is carried away with the water and settles down in about two days in a tank, when the clear water on the top is run away into the sewer. The wet starch is removed from the tables and dried in kilns, which are heated by closed steam pipes, or hot air is forced in by means of fans.

Analysis of Starch ($C_6H_{10}O_5$) for the Manufacture of Glucose.

Starch (pure)	88·45
Fibre (cellulose)	0·00
Ash	0·13
Proteine (gluten)..	0·49
Fat (oil)	0·04
Moisture	10·89
Total	100

9. Drying and Filtering the Gluten.

The water still adhering to the gluten is pressed out in a filter press and the gluten cakes are taken from the presses after a short time, dried in hot air stoves and packed in bags.

Gluten, which is of a greyish appearance, is much esteemed as a cattle food under the name of "gluten meal." Very often gluten is mixed with bran and sold as "gluten feed."

Gluten (vegetable albumen) contains four different albuminoids:—
1. Gluten-casein. 2. Gluten fibrin. 3. Mucidin. 4. Gliadin.

Of 100 parts of gluten nearly one half are digestible, and the remainder indigestible.

As all the other constituents of corn are removed we now come to the treatment of the starch itself.

10. The Manufacture of Glucose proper.

(a)—The Conversion of Starch into Glucose.

This is done in a vessel having a capacity of half a ton of starch, in which the starch is chemically changed into glucose. In this converter the starch is mixed with water, and a calculated quantity of sulphuric or hydrochloric acid. The converter is fitted with a perforated steam pipe, through which direct steam is introduced. The complete conversion takes half an hour at a steam pressure of about 50 lbs., and the conversion is at an end when the known chemical test shows that all the starch is converted.

After the completion of the inversion the glucose is sent to:—

(b)—The Neutralisation Tank.

The glucose entering the neutralisation tank is a brownish liquid of a specific gravity of 1·179. This process gets rid of the free acid which is done by means of carbonate of soda if hydrochloric acid was used, or of chalk or marble dust if sulphuric acid has been used.

After the neutralisation process comes:—

(c)—The Filtration,

which is done in a filter press or through Taylor filter bags. The thin and clear liquor running off from the mechanical filters is then sent to the next operation.

(d)—Filtration over Animal Charcoal.

From the char cisterns the "thin liquor" runs perfectly bright and colourless but to give it the necessary thickness it is treated by another process:—

(e)—Evaporation,

in which the thin liquor is evaporated in a quadruple effect, where it is brought to the proper thickness of a specific gravity of 1·296 or 33°

Beaumé. The thick liquor of this consistency is again passed through animal charcoal to get rid of any trace of yellow colour which the liquor contains.

The liquor coming from the charcoal filter is treated by the next process:—

(f)—Boiling in the Vacuum Pan.

where it is boiled to the desired thickness of 41° or 44° Beaumé according to the demand. The boiled glucose is now sent into a tank containing a sieve and is then filled into barrels.

Glucose must be perfectly clear and colourless, and must leave no after-taste in the mouth.

The greatest glucose factories are in America, and the following is a report of the largest, belonging to the Glucose Trust Co.

"The balance sheet submitted on the 22nd August, 1898 by the Directors of this Company shows that from August, 1897, to June 30th, 1898, they ground 639,123 tons of maize from which were produced 271,050 tons of glucose, 49,191 tons solid dextrose, 60,486 tons starch, 1,300 tons dextrine, and 158,788 tons of residue.

The net profit for 10½ months was $1,863,157 after writing off $589,192 for improvements and repairs."

This American Glucose Trust Company has a capital of $40,000,000, of which $26,000,000 are ordinary shares, and $14,000,000 preference shares.

The Trust is formed of the following companies:—

Chicago Sugar Refining Co... ..	Chicago.
The Davenport Refining Co.	Davenport, Ill.
The Firmenich Glucose Co.	Chicago.
The Peoria Glucose Co.	Peoria, Ill.
The American Glucose Co.	Peoria, Ill.
The Rockford Glucose Co..	Rockford, Ill.

Independent companies are:—The Charles Pope Co. (factories in Geneva and Venice, Ill.), and the National Starch Co., Glen Cove, L.J.

Exports of glucose from the United States of America:—

Year.	Short tons.	Value in dollars.	Year.	Short tons.	Value in dollars.
1884	3,386	212,628	1891	29,024	1,394,131
1885	913	60,078	1892	48,243	2,272,779
1886	1,286	67,775	1893	50,773	2,204,216
1887	2,238	118,620	1894	62,398	2,328,707
1888	3,131	163,573	1895	66,904	2,567,784
1889	15,642	748,560	1896	85,615	2,772,335
1890	19,128	855,176	1897	93,495	2,676,600

Glucose exported from the United States to the United Kingdom :—

	Tons.		Value.
1896..	71,634	....	£523,963

Dextrine or starch gum is made from the dry starch described above by drying it at a still higher temperature.

From "dextrine" another product is manufactured known to commerce under the name of "American gum" which is used as a substitute for gum arabic. This American gum is also used in the preparation of pepsin and also by confectioners for coating certain candies.

THE SUGAR INDUSTRY OF MAURITIUS,

Abstract of Paper read at a Meeting of the Royal Colonial Institute, Tuesday, December 13th,

BY JAMES FORRESTER ANDERSON, ESQ.

In this Paper the Author gives an insight into the staple industry of the island of Mauritius from its early days to the present time, by telling us first of the sugar cane, its introduction in the island about the year 1747 under the French Governor, Mahé de Labourdonnais, from the Dutch East Indies, the first sugar factory belonging to Monsieur Mahé de La Villebague, the Governor's brother; the cultivation of the cane, and the various modes of propagation from the stem, the "tops" or heads, and the seeds, the last mode being a thing of reality only eight or nine years ago. In speaking of the various species of the cane, the Author dealt with the comparative richness in sugar of certain species, the diseases of the cane, the havoc made by the destructive caterpillar, the "Borer" (*Xyleborus perforans*), the only remedy for which is the cutting away of the contaminated stem and burning it. The disappearance of former rich species of cane, which yielded an average of five tons per acre, is due, according to Mr. Anderson's opinion, to the exhaustion of the soil and to the continuous cultivation of a single species from year to year, the feebleness of constitution thus produced rendering the cane more liable to disease. Several estates have been worked over ninety years without intermission; hence the soil needs to be renovated by high doses of guano and good manure, and when the planter to-day realises an average crop of two tons per acre he considers himself most fortunate; this is far from the handsome average of bygone years, when his predecessors

were able to get £1 8s. per cwt. for their sugars, instead of 8 rs.—*i.e.*, 10s. 8d.—or even less, which is the present day average market-price, due to the abnormal and unfair competition of the bounty-fed beet sugar on the Indian and European markets.

The Author enumerated the difficulties against which the Mauritius planter has to contend—viz., droughts, diseases of the cane, coupled with the attack by the "Borer," and cyclones. Droughts, which are now much more frequent than in the past, are undoubtedly occasioned by the stagnation of the watercourses, specially in the lowlands, brought on by deforestation, which has been the cause of ruin to many an estate, and which has carried desolation and barrenness into localities once rich in luxuriant vegetation, in which the much-to-be-dreaded malaria was never known before. The only radical remedy, Mr. Anderson asserts, is for the Government to buy up *all* the lands surrounding the watercourses and re-wood them with good, hardy forest trees; but the Local Government is altogether unable to do anything in that direction without material help from the Home Government.

A cyclone is the most terrible foe of the Mauritius planter, an instance of which the Author was an eye-witness of in the month of April 1892, when the standing crop was reduced by 30,000 tons on the preceding, and the following crop by 7,000 on the cyclone year—viz., from 124,000 tons of 1891-92 to 94,000 in 1892-93, and from 94,000 (1892-93) to 87,000 in 1893-94. The planter passes through anxious times from the month of October to the month of May, the hurricane season; hence the barometer is a most valuable piece of furniture in the Mauritian home. The island pulled itself up, however, soon after, for the very next two years the crop rose to an average of 128,000 tons, last year to that of 120,000, or a little over, and the present crop, 1898 to 1899, promises to be the handsomest on record for many years past, being estimated at a minimum of 150,000 tons. Considering the somewhat unsurmountable obstacles in the way, the Mauritius planter is surely to be congratulated for his spirit of energy and enterprise in face of the ravages of the bounty-fed monster in the markets of the world. He is doing his very best to produce his sugar at the lowest possible cost, which could never be lower than 6 rs. (8s.) per cwt. (50 kilos.), as only at that cost will he be able to derive a reasonable profit on his sales. Many an estate did not realise more than 7·80 rs. (8s. 9d.) as their average last year, and could hardly put anything by.

The sugar crops, or rather the exports of sugar, for the last ten years to 1896, were in round numbers as follows:

	Tons, (1,000 kilos. per ton).
1886-1887	102,376
1887-1888	124,073
1888-1889	132,172
1889-1890	124,564
1890-1891	129,443
1891-1892	124,759
1892-1893	94,097
1893-1894	87,408
1894-1895	139,449
1895-1896	117,430

(*Garrioch's Mauritius Almanac, 1898.*)

The largest exportation is to *India*, which in 1896 took over 48,000 tons, while *Australia*, which at first took the most of the sugars of the island, received only 13,000 and odd tons; *Cape Colony* surpassed her by 3,000 tons; the *United States of America* now stand fourth in the Mauritius sugar markets, taking in 1896 about 10,000 tons.

After passing in a cursory review the various improvements in machinery for the conversion of the saccharine juice into crystallised sugar which have superseded the old systems or processes of the original planters, who in Mauritius have always been sugar makers at the same time, Mr. Anderson spoke of the diffusion process, which two estates, "Britannia" in the south and "Mon Rocher" in the north, tried not long since; but these estates had to give up this new process on account of the costly items of fuel and labour it entailed, and also for other reasons. Besides the natural difficulties, enumerated above, the planter has to meet the material difficulties in the heavy items of his budget, such as fuel, guano, rice and grain, and monthly wages, all of which are now higher than in the time of his forefathers. The Paper, in dealing with the Coolie labour question, a very vexed question some twelve or fourteen years ago, showed how, through the judicious working of the New Labour Law, a cordial *entente* now reigns between the planter and his labourers. One of the Governors of the island, Sir Arthur Gordon, now Lord Stanmore, inaugurated an era of contentment and happiness for the Indian labourers by grappling the thorny question in all its aspects, which has resulted in establishing that spirit of mutual goodwill between employer and employeê conducive to the prosperity of the Colony. An evidence

among others of the welfare of the Indian labourer in the island is that more than one have had to their credit in the Government Savings Bank deposits of 3,000 rs., or more, and a still more important fact is that some are now proprietors or co-proprieters of sugar estates.

The above facts, apart from the equally vital question of India being now the chief market for the Mauritius sugars, and the Indian population of the island being in the majority, have an indisputable claim to the serious attention of the Indian Government in the burning question of the day—namely, the protection of the importation of the Mauritius sugars into that Empire against the bounty-fed beet sugar which is overwhelming its markets. The welfare of the Indians in Mauritius, as well as of all the other inhabitants, depends entirely upon the success and prosperity of the sugar industry of the island.

On the other hand, the Mauritians cannot and will not lose the hope and confidence which they have ever had in the affection and devotion of their exalted Sovereign for all her people, however remote from her throne some of them may be, and in whose royal crown Mauritius, shines with as bright a lustre of loyalty and devotedness as any larger jewel in that great Monarch's diadem.

COUNTERVAILING DUTIES AND CANE SUGAR.

The following is a translation of the reply of the *Deutsche Zucker-industrie* (November 4th, col. 1554-56) to the letter addressed to the Editor by Mr. Nevile Lubbock, copy of which appeared in the November *Sugar Cane*, pp. 600-601:—

Differential Duty and the Price of Raw Sugar.

Mr. N. Lubbock, the well-known Chairman of the West India Committee in London, writes to us:—

I have read with interest your article in No. 42, S. 1492, intituled "Differentialzoll und Rohrzuckerpreis," and whilst not wishing to go into the arguments which you so ably put forward, I would like to point out to you that, as a matter of fact, since the countervailing duties came into operation in the United States, the price of the West Indian cane sugar in that country, relatively to beet, has been at least £1 sterling per ton higher than before those duties were instituted.

Therefore the West Indian producer is now receiving a price which, as compared with the price for beet sugar, is higher to the extent of the German bounty than before the American differential duty.

Well now, the quotations in New York, before the introduction of the differential duty, were:—

	West India Centrif. 96°. Per lb.	Mk. Per Ctr.		Beet Sugar 88°. Per cwt. s. d.	Mk. Ctr.
5th March, 1897 ..	2·27cts. =	10·40	....	9 $2\frac{1}{4}$ =	9·25
28th May, 1897 ..	2·32cts. =	10·65	....	9 $0\frac{3}{4}$ =	9·12
After the introduction of the duty:—					
5th March, 1898 ..	$2\frac{7}{16}$cts. =	11·18	....	9 $7\frac{1}{2}$ =	9·67
23rd May, 1898 ..	$2\frac{19}{32}$cts. =	11·90	....	10 $1\frac{1}{2}$ =	10·17

After the differential duty, therefore, West India sugar was quoted higher than beet sugar, in the one case by Mk.1·51, in the other by Mk.1·73.—Average, Mk.1·62.

Before the differential duty, West India sugar was quoted higher than beet, in the one case by Mk.1·13, in the other by Mk.1·53.—Average, Mk.1·34.

Therefore, West India sugar gained in price, after the introduction of the differential duty, 28pf. per Ctr. This is, as Mr. Lubbock will admit, a somewhat smaller amount than the German bounty, but even this small gain in price will prove deceptive if we take the trouble to extend the comparison over a larger number of quotations for cane and beet sugar.

Up to now then, Mr. Lubbock has believed, and will continue to believe, that for his West India sugar he is now receiving, in comparison with beet sugar, Mk.1·25 more than formerly. But why then does he continue to make war upon the bounties and urge their abolition? He hopes that in consequence the world's price will rise by Mk.1·25, but he also knows that the differential duty in America would be abolished, in consequence of which that extra price of Mk.1·25, which the West India sugar is asserted to be receiving, would likewise disappear. He already possesses that which he hopes to obtain by the abolition of the bounties, from which it conclusively follows, either that the agitation for the abolition of the bounties is a senseless one, or that the West India producers have, in reality, no advantage in price and consequently continue the agitation for abolition of the bounties in order to obtain an improvement in the price. Mr. Lubbock will now admit that if the *West Indians* receive *a higher price* in the American market than is paid for beet sugar, we *must* get *less* in America for our sugar than when we export it to England, where there is no differential duty. This assumption is, however, at once refuted by the indisputable fact that the German manufacturer, when he sells sugar, receives *the same price* whether he sells it at home or to a foreign country, no matter which. Mr. Lubbock has confuted himself, since in his letter to us he remarks as follows:—

May I also suggest for your consideration the proposition that German sugar producers gain but little or no pecuniary advantage from the bounties paid by their Government. When they sell sugar to England, for instance, they only obtain a price which is less, to the extent of the bounty, than they would get if there were no bounty, and as a result the English consumer alone obtains the benefit of the bounty, in the lower price which he has to pay. Again, when German sugar is sold to the United States, the German producer, in consequence of the differential tax, or countervailing duty, receives a lower price than he would if there were no bounty and no countervailing duty, by so much as will enable the American purchaser to pay to the United States' Treasury the countervailing duty demanded; in this case the American Treasury gets the benefit of the bounty.

In other words, the German producer is as badly off when selling to England as to America, in both cases he loses the bounty. This last is in itself naturally totally incorrect, for the German producer *gets the bounty on both cases;* all that is worth notice in the entire statement is that in the opinion of Mr. Lubbock the German producer is in the same position with regard to the total export, whether he sells to England or to America, while previously he stated that the German producer received *less* for his sugar when he sells to America than when he sells to England. He has therefore confuted himself, just as has been the case with all previous supporters of the curious theory that our bounties, in consequence of the American differential duty, disappear. This dispute as to the working of the differential duty on the price of cane sugar affords proof that economical questions concerning public life are treated in an incredibly superficial manner. Is the differential duty of the Americans anything new or unheard of, that as regards its working new and most grotesque theories need be brought forward? Had we not already, between 1894 and 1897, an American differential duty on bounty-fed sugar? Can any difference in the working of the result because the former duty was only $\frac{1}{10}$c. per lb., equal to 6pf. per ctr., while the existing duty amounts to Mk.1·25? It never occurred to anyone between 1894 and 1897 to imagine that the Americans took one-third of our bounty. But now, when the duty amounts to as much as the bounty, everyone who—while clinging to the mere appearance of things—avoids going to the root of matters, affirms that in dealing with America we forfeit our bounties.

That the "Centrablatt," *e tutti quanti*, embrace this opinion is of no importance, but that Mr. Lubbock, the fellow-countryman of the great price-theorist Adam Smith, has no better intuitions respecting the elements which go to form the price of his own staple article, fills us with dismay. Does not Mr. Lubbock know the great difference there is in the formation of the price of the grown and the manufactured article?

Tinplate, for example, is a manufactured article, *i.e.*, always capable of increased production. Suppose now, the Americans were to lay a differential duty on English tinplate to-day. The consequence would be that the English tinplate makers would only continue to sell to America if they themselves lowered the price by the amount of the differential duty. English tinplate would then be quoted in America cheaper to the extent of the differential duty than tinplate from other sources. Why? Because the competitors of the English makers would immediately produce so much more tinplate as the English tinplate makers previously sent to the American market. With articles capable of increased production at any time the differential duty will increase the production, and consequently the price will fall.

Products of cultivation, however, such as corn, spirits, sugar, are not capable of indefinite increase, since in each year only that can be brought to market which is already grown, and hence the quantity offerable, notwithstanding the differential duty, remains the same, and consequently the price remains the same. For this reason, differential duties imposed on manufactured products have a fatal effect on the particular industry affected; on agricultural products, on the contrary, they have no effect, and therefore it is *impossible* that in consequence of the differential duties of the Americans on bounty-fed sugar, such bounty-fed sugar has to be sold in the American market cheaper, to the extent of the bounty, than colonial sugar. Adam Smith, of blessed memory, if he had had to read the letter of his fellow-countryman Lubbock, would have had a fit of convulsions.

[Further correspondence has taken place on this very interesting and important question, but want of space compels us to reserve this for our February issue.—ED. *I. S. J.*]

The consumption of sugar in France amounts at present to nearly 450,000 metric tons.

Sorghum continues to be extensively cultivated in Wisconsin and Minnesota, and syrup is manufactured for home consumption, but there is no longer any hope of its competing with cane or beet sugar.

A report, which was current at the beginning of December, of a consolidation of interests between the whole of the American Refineries and the Glucose Sugar Company, of Chicago, proves to be at present unfounded.

SUGAR BEET GROWING IN ENGLAND, SCOTLAND, AND IRELAND, 1898.

By Sigmund Stein,

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(Fourth Report.)

In publishing the remaining and last analyses which I have made of the beet sugar roots grown according to my directions in the United Kingdom, I can only repeat my previous remarks and observations. It is evident from these analyses that these beet growing experiments are a success in the truest sense of the word.

The saccharine content of the sugar beets grown this year in the United Kingdom considerably exceeds the average of those grown in Germany, Austria, Russia, France, Belgium, and Holland. The yield of roots per acre is also higher in British-grown roots than in those grown on the Continent, and I shall publish figures relating to this in a later number of this journal.

Nearly all the roots were well shaped and in proper condition. The soil varied, as is shown in the tables, and all kinds of manures were used. In the latter connection, I would draw special attention to the experiments made on the different Corporation Sewage Farms, which have been very successful in respect of saccharine content, as well as yield per acre.

The roots were grown from all the best-known French, German, and Russian, and also from several kinds of English seed. As previously mentioned, I supplied the seed to the experimenters gratuitously and carriage paid in parcels varying from 1 lb. to 60 lbs. each.

I wish once more to thank the numerous friends, the press, and all growers, farmers, and experimenters who have helped me in my endeavours, and I feel sure they will all be satisfied that these experiments turned out so successfully.

I think my extensive experiments have conclusively proved the suitability of our climate, our soil, and our conditions for growing even better sugar beets than those of the Continent, and energetic steps must now be taken to establish a beet sugar factory in this country. Very great interest is being taken in this question, as is proved by the many letters I have received and the extensive correspondence which has taken place upon the subject.

Many of my analyses, some of them extremely satisfactory, I am unable to publish, either owing to no particulars having reached me, or in many cases to inability to ascertain the name of the sender.

I.—ENGLAND.

Reference Number.	Trial made by	Farming at	Kind of Soil.	Manure used, and Quantity per Acre.
189	Mr. S. N. Neck	E. Steward's Farm, Moreton Hampstead, Devon.	Granitic	4 cwt. salt, 4 cwt. dissolved bones, $\frac{1}{2}$ cwt. nitrate of soda.
94	Rev. W. F. Vernon	Wickwar, Rangeworthy, Gloucester	Ordinary soil, clay subsoil.	Farmyard manure.
114	Mr. W. W. Keel	Rectory Farm, Stanton Drew, near Bristol, Somerset.	Light loam	3 cwt. superphosphate, 2 cwt. nitrate of soda, 15 loads farmyard manure, 3 cwt. kainite.
153	Mr. John Done	Winnington Lodge, Winnington, Northwich.	Light	Leaf and cow manure.
154	Mr. F. W. South	Ramsden Farm, Benenden, Cranbrook, Kent.	Clay	None.
165	Mr. F. S. Nash	Aldeby Grove Farm, Beccles, Norfolk	Strong loam, clay subsoil.	10 loads farmyard manure.
168	Mr. C. Burrows	Malting Works, Southminster, Essex.	Rich loam, clay subsoil	Farmyard manure.
167	Mr. A. W. Turner	The Grove, Staplegrove, Taunton, Somerset.	Loamy	20 loads farmyard manure.
171	Miss C. H. Penruddock	Compton Park, Salisbury	Loamy	Moss litter and stable manure, carbonate of potash.
178	Mr. W. Hutchinson	Gunby Selty Farm, near Selby, Yorkshire.	Sandy, clay subsoil	10 loads farmyard manure, 4 cwt. bones, 2 cwt. guano, 1 cwt. nitrate of soda.
179	Mr. H. L. Elliott	Moreton Hampstead, Devon	Light sandy	4 cwt. salt, 4 cwt. dissolved bones, $\frac{1}{2}$ cwt. nitrate.
181	Mr. J. J. Harrison	Overdale, Aylestone, Leicester	Clay loam, clay subsoil	None.
184	Mr. R. W. Tuddenham	Kenningham Hall, Mulbarton, Norwich	Loam, clay subsoil	15 tons dung, 4 cwt. Peruvian guano, 3 cwt. damaged malt.
185	Mr. R. Coulthard	Treffos, Menai Bridge, Anglesey	Medium loam	Farmyard manure, 5 cwt. superphosphate.
186	Mr. J. L. Stevens	Kingscombe, Linkinhorne, Cornwall	Light	Farmyard manure, top dressing of bones, 15 cwt. of phosphate and salt.
190	Mr. W. P. Hoblyn	The Fir Hill, St. Columb, Cornwall	Heavy loam on clay	Nitrate of soda, kainite, superphosphate.

Reference Number.	Duration of Growth.	Previous Crop.	Schreiber (German Seed), "Specialité Elite."					Vilmorin (French Seed), "Elite."					Pitzschke (German Seed), "Elite."					Compared with F.O. Licht, Magdeburg.			
	Days.		Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.
189	180	Turnips	857	18·90	2·90	86·69	18·00	....	....	....	....	....	....	....	....	....	....	580	16·75	3·15	84·17
94	142	Potatoes	....	....	....	....	....	....	....	....	....	....	1625	12·30	2·40	83·67	11·60	580	16·75	3·15	84·17
114	161	Oats	1260	14·20	2·10	87·11	13·50	1170	14·00	2·40	85·36	13·50	....	....	....	....	....	580	16·75	3·15	84·17
153	191	Broad beans ..	847	19·00	2·60	87·96	18·20	743	17·50	2·90	85·78	16·80	....	....	....	....	....	580	16·75	3·15	84·17
154	163	Wheat	814	16·70	2·70	86·08	16·00	....	....	....	....	....	....	....	....	....	....	580	16·75	3·15	84·17
165	196	Wheat	1658	17·60	2·90	85·85	17·00	1023	18·60	3·00	86·11	17·80	....	....	....	....	....	580	16·75	3·15	84·17
168	151	Potatoes	....	....	....	....	....	1630	17·10	2·90	85·50	16·30	1640	13·60	3·10	85·71	17·90	580	16·75	3·15	84·17
167	189	Wheat	856	18·40	2·70	87·20	17·20	....	....	....	....	....	....	....	....	....	....	580	16·75	3·15	84·17
171	160	Mangolds	956	18·20	2·70	87·08	17·30	867	17·40	2·40	87·87	16·40	....	....	....	....	....	580	16·75	3·15	84·17
178	182	Oats	....	....	....	....	....	1890	15·70	2·60	85·78	15·00	....	....	....	....	....	580	16·75	3·15	84·17
179	170	Turnips	1242	16·80	3·20	84·00	16·10	....	....	....	....	....	....	....	....	....	....	580	16·75	3·15	84·17
181	153	Peas	884	19·30	2·40	88·94	17·90	992	17·00	2·61	86·73	16·10	....	....	....	....	....	580	16·75	3·15	84·17
184	204	Wheat	1232	18·00	2·20	89·10	17·10	991	16·80	2·30	87·95	16·00	....	....	....	....	....	580	16·75	3·15	84·17
185	191	Oats	932	18·40	2·30	88·88	17·70	961	19·70	2·30	89·54	18·90	....	....	....	....	....	580	16·75	3·15	84·17
186	169	Mangolds	....	....	....	....	....	859	17·40	2·30	88·32	16·70	....	....	....	....	....	580	16·75	3·15	84·17
190	194	Grass	....	....	....	....	....	1145	18·10	2·70	87·02	17·30	....	....	....	....	....	580	16·75	3·15	84·17

I.—ENGLAND—*Continued.*

Reference Number.	Trial made by	Farming at	Kind of Soil.	Manure used, and Quantity per Acre.
156	South Eastern Agric. College (Principal, A.D. Hall, Esq.)	Wye, near Ashford, Kent.............	Light loam, on chalk..	15 tons dung, 2 cwt. superphosphate, 1 cwt. salt, 1 cwt. kainite, 2 nitrate of soda.
158	Mr. W. Richardson........	Holgate, York	Sandy	None.
172	Mr. G. P. Bazeley	Penzance, Cornwall	Light sandy	10 loads stable manure.
175	Mr. J. F. Crocker..........	South Parks Farm, St. Mary Church, near Torquay.	Stiff, red sand subsoil..	3 cwt. dissolved bones, 5 superphosphate, 2 cwt. guano, $1\frac{1}{2}$ cwt. sulphate of ammonia, 6 cwt. salt, 11 hhds. of lime.
181	Mr. J. Harrison	Overdale, Aylestone, Leicester	Clay loam, clay subsoil	None.
181	Mr. J. Harrison	Overdale, Aylestone, Leicester	Clay loam, clay subsoil	None.
185	Mr. R. Coulthard	Treffos, Menai Bridge, Anglesey	Medium loam	Farmyard manure, 5 cwt. superphosphate.
187	Mr. E. Clode..............	Sidcliff Farm, Sidmouth, Devon	Clay loam	10 tons farmyard and fish manure.
188	Mr. H. Bates..............	Goodgroom's Farm, Robertsbridge, Sussex.	Loam	None.
156	South Eastern Agric. College (Principal, A.D. Hall, Esq.)	Wye, near Ashford, Kent	Light loam, on chalk..	15 tons dung, 2 cwt. superphosphate, 1 cwt. salt, 1 cwt. kainite, 2 cwt. nitrate of soda.
174	Mr. William Sampson	Beauchief Abbey, near Sheffield	Loam, clay subsoil	20 tons farmyard manure.
176	Mr. E. Hosking	Great Rosevidney, Long Rock, Cornwall	Clay loam, clay subsoil	16 cwt. mangold manure, 2 cwt. nitrate of soda.
187	Mr. E. Clode..............	Sidcliff Farm, Sidmouth, Devon	Clay loam	10 tons farmyard and fish manure.

Reference Number.	Duration of Growth.	Previous Crop.	Mette (German Seed), "Wanzleben."					Janasz (Russian Seed), "Zuckerreiche."					Simon Legrand (French Seed), "Blanche."					Compared with F. O. Licht, Magdeburg.			
	Days.		Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.
156	172	Barley	613	16·30	2·30	87·63	15·40	531	18·30	2·40	88·40	17·20	530	18·80	2·60	87·85	18·00	580	16·75	3·15	84·17
158	129	Rhubarb	....	....	....	....	....	1545	17·10	2·30	88·14	16·40	....	....	....	....	....	580	16·75	3·15	84·17
172	200	Various vegetables.	1356	17·60	2·20	88·88	17·00	3110	14·50	2·40	85·79	13·90	1955	16·20	2·40	87·09	15·50	580	16·75	3·15	84·17
175	171	Rye	....	....	....	....	....	973	18·00	3·30	84·50	17·10	1530	18·90	2·90	86·69	18·00	580	16·75	3·15	84·17
181	153	Peas	945	17·10	2·70	86·36	16·40	....	....	....	....	....	....	....	....	....	....	580	16·75	3·15	84·17
181	153	Peas	837	17·90	2·90	86·06	17·00	....	....	....	....	....	....	....	....	....	....	580	16·75	3·15	84·17
185	191	Oats	851	19·20	2·60	87·61	18·00	....	....	....	....	....	....	....	....	....	....	580	16·75	3·15	84·17
187	173	Rye	....	....	....	....	....	....	....	....	....	....	955	17·60	2·70	86·69	16·80	580	16·75	3·15	84·17
188	161	Potatoes	....	....	....	....	....	....	....	....	....	....	985	19·50	2·20	89·86	18·60	580	16·75	3·15	84·17
			Schreirer (German Seed), "Elite."					Breustedt (German Seed), "Elite."					Schlieckmann (German Seed), "Elite."					Compared with F. O. Licht, Magdeburg.			
156	172	Barley	745	18·70	3·70	83·48	18·10	893	18·30	2·70	87·14	17·40	722	16·70	2·70	86·08	16·00	580	16·75	3·15	84·17
174	148	Cabbage	711	19·20	2·40	88·88	18·30	637	17·20	2·90	85·57	16·10	590	17·20	2·70	86·43	16·60	580	16·75	3·15	84·17
176	173	Brocoli	1955	19·60	3·10	86·34	18·70	....	....	....	....	....	....	....	....	....	....	580	16·75	3·15	84·17
187	173	Rye	....	....	....	....	....	....	....	....	....	....	1269	16·30	3·10	81·02	15·70	580	16·75	3·15	84·17

I.—ENGLAND—*Continued.*

Reference Number.	Trial made by	Farming at	Kind of Soil.	Manure used, and Quantity per Acre.
185	Mr. R. Coulthard	Treffos, Menai Bridge, Anglesey	Medium loam	Farmyard manure, 5 cwt. superphosphate.

Reference Number.	Trial made by	Farming at	Kind of Soil.	Manure used, and Quantity per Acre.
114	Mr. W. W. Keel	Rectory Farm, Stanton Drew, near Bristol.	Light loam	15 loads farmyard manure, 3 cwt. kainite, 3 cwt. superphosphate, 2 cwt. nitrate of soda.
161	Mr. E. G. Cubitt	Manor Farm, Honing Hall, Worstead, Norfolk.	Rich soil, loam subsoil	10 loads of farmyard manure.

Reference Number.	Trial made by	Farming at	Kind of Soil.	Manure used, and Quantity per Acre.
130	The Agricultural and Horcultural Association.	Dyott Street, Oxford Street, London..	Sandy loam, sand subsoil.	24 loads horse manure, 8 cwt. artificial manure.

Reference Number.	Duration of Growth. Days.	Previous Crop.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.
			METTE (German Seed), "Vilmorin.															Compared with F. O. LICHT, Magdeburg.			
185	191	Oats	786	16·40	3·00	84·54	15·70	....	....	....	....	....	....	....	....	....	....	580	16·75	3·15	84·17
			METTE (German Seed), "Wanzleben."					SUTTON (English Seed), No. 1.					SUTTON (English Seed), No. 2.					Compared with F. O. LICHT, Magdeburg.			
114	161	Oats	1450	13·00	2·20	85·52	12·60	....	....	....	....	....	....	....	....	....	....	580	16 75	3·15	84·17
161	173	Wheat	....	....	....	....	....	1173	10·60	2·30	82·17	10·00	1840	10·20	3·10	76·69	9·60	580	16·75	3·15	84·17
			AGRICULTURAL ASSOCIATION (English Seed), "Richest of all."					AGRICULTURAL ASSOCIATION (English Seed), "Red Silesian."										Compared with F. O. LICHT, Magdeburg.			
130	167	Potatoes	875	14·90	2·40	86·12	14·20	1066	13·70	2·30	85·62	13·10	....	....	....	....	....	580	16·75	3·15	84·17

I.—ENGLAND—*Continued.*

Reference Number.	Trial made by	Farming at	Kind of Soil.	Manure used, and Quantity per Acre.
28	The Liverpool Corporation Sewage Farm.	Walton, Liverpool	Clayey	Sewage.
28	Do. do. do.	Do. do.	Garden soil	10 tons horse manure.
159	Do. do. do.	Do. do.	Strong land, clay subsoil	Sewage.
159	Do. do. do.	Do. do.	Light land, sand subsoil	Sewage.
164	Mr. S. Symons	Camborne, Cornwall	Light loam	15 tons farmyard manure, ½ cwt. guano, ½ cwt. dissolved bones, ½ cwt. superphosphate.
27	The Liverpool Corporation Sewage Farm.	West Derby, Liverpool	Strong heavy land	10 tons horse manure and sewage.
27	Do. do. do.	Do. do. do.	Medium light land	15 tons horse manure (without sewage).
134	Do. do. do.	Do. do. do.	Strong heavy land	10 tons horse manure and sewage.
134	Do. do. do.	Do. do. do.	Medium light land	15 tons horse manure (without sewage).
27	The Liverpool Corporation Sewage Farm.	West Derby, Liverpool	Medium light land	10 tons horse manure (without sewage).
27	Do. do. do.	Do. do. do.	Do. do.	Sewage.
134	Do. do. do.	Do. do. do.	Do. do.	10 tons horse manure (without sewage).
134	Do. do. do.	Do. do. do.	Do. do.	Sewage.
163	Ormskirk Corporation Sewage Farm.	Ormskirk, Lancaster	Stiff loam, clay subsoil.	Sewage.
150	Mr. G. Steedman	Shirton le Steeple, Retford, Nottinghamshire.	Clay, red clay subsoil	15 tons mangold manure.
151	Mr. A. J. Wells	Westfield Farm, Hatfield, Doncaster	Dark loam, sand subsoil	16 tons farmyard manure, 10 cwt. of basic slag, 5 cwt. salt.

Reference Number.	Duration of Growth. Days.	Previous Crop.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of the Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of the Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of the Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.
			KLEIN (Russian Seed), "Vilmorin."					ADERSTEDT (German Seed), "Original."					KLEIN (Russian Seed), "Wanzleben."					Compared with F. O. LITCH, Madgeburg.			
28	153	Potatoes	578	13·50	2·10	86·54	12·30	846	14·60	2·50	85·38	13·40	624	16·80	2·40	87·50	15·20	393	15·30	2·50	85·96
28	134	Cabbage	816	15·00	2·40	86·20	13·90	784	16·10	2·30	87·50	15·00	419	13·80	2·40	85·17	12·90	393	15·30	2·50	85·96
159	206	Potatoes	1070	18·80	2·80	87·04	18·10	835	18·00	3·70	82·95	17·20	....	....	....	....	....	580	16·75	3·15	84·17
159	206	Cabbage	973	18·50	2·40	88·51	17·80	1131	19·70	2·90	87·17	19·00	....	....	....	....	....	580	16·75	3·15	84·17
164	187	Mangolds	1023	17·30	2·40	87·82	16·10	....	....	....	....	....	....	....	....	....	....	580	16·75	3·15	84·17
			JANASZ (Russian Seed), "Zuckerreiche."					BRAUNE (German Seed), "Vilmorin."					SUTTON (English Seed).					Compared with F. O. LITCH, Madgeburg.			
27	128	Oats	390	13·90	2 20	86·33	13·00	587	14·30	2·30	86·14	13·00	381	14·30	2·10	87·19	13·20	393	15·30	2·50	85·96
27	134	Potatoes	369	15·80	2·60	85·86	14·60	617	14·60	2·70	84·39	13 70	548	9·80	2·80	77·77	9·00	393	15·30	2·50	85·96
134	168	Oats	833	15·30	2·60	85·46	14·80	991	16·50	3·00	84·61	16·00	749	17·70	2·60	87·19	17·20	580	16·75	3·15	84·17
134	184	Potatoes	600	16·10	2·40	87·03	15·60	615	19·00	2·90	86·75	18·10	537	16·90	2·20	88·48	16·30	580	16·75	3·15	84·17
			BRAUNE (German Seed), "Wanzleben."					METTE (German Seed), "Wanzleben."					SCHREIBER (German Seed), "Elite"					Compared with F. O. LICHT, Magdeburg.			
27	134	Sewage grass..	986	12·00	2·60	82·19	11·20	....	....	....	....	....	....	....	....	....	....	393	15·30	2·50	85·96
27	134	Sewage grass..	426	14·20	2·10	87·11	13·10	....	....	....	....	....	....	....	....	....	....	393	15·30	2·50	85·96
134	184	Sewage grass.	745	18·60	2·50	88·15	18·00	....	....	....	....	....	....	....	....	....	....	850	16·75	3·15	84·17
134	184	Sewage grass.	972	17·90	2·40	88·17	17·20	....	....	....	....	....	....	....	....	....	....	850	16·75	3·15	84·17
163	172	Oats	....	....	....	....	....	892	17·30	2·40	87·81	16·60	956	17·60	2·70	86·69	16·90	850	16·75	3·15	84·17
			SCHREIBER (German Seed), "Zuckerriciche."					VILMORIN (French Seed), "Elite."					METTE (German Seed), "Wanzleben."					Compared with F. O. LICHT, Madgeburg.			
150	178	Potatoes	1436	17·30	3·10	84·80	16·80	1137	17·30	2·40	87·81	16·40	....	....	....	....	....	580	16·75	3·15	84·17
151	198	Oats	1430	16·40	2·30	87·70	15·90	....	....	....	....	....	....	....	....	....	....	580	16·75	3·15	84·17

II.—SCOTLAND.

Reference Number.	Trial made by	Farming at	Kind of Soil.	Manure used, and Quantity per Acre.
173	Mr. J. Shearer	Craigellachie, Banffshire	Sandy loam on gravel	24 tons farmyard manure, 3 cwt. special manure, 2 cwt. kainite.
152	Mr. R. Ironside	Auchlossan, Lamphanan	Alluvial	16 tons farmyard manure, 4 cwt. kainite.
162	Mr. W. Muirhead	Gloverhill Farm, Knightwood, Glasgow	Light loam, clayey subsoil.	35 tons farmyard maunre, 2 cwt. nitrate of soda.

III.—IRELAND.

127	Mr. Thomas Ennis	Montgomery Estate, Kirkistown, Kircubbin.	Loam, clay subsoil	10 tons stable manure, 4 cwt. superphosphate.
128	Mr. Hugh Bailie	Kirkistown, Kircubbin, Co. Down	Black loam	Farmyard manure and superphosphate.
129	Mr. T. Thompson	Kirkistown, Kircubbin, Co. Down	Loam	Stable manure and superphosphate.
141	Mr. R. Dobbyn	Ballynakill House, Co. Waterford	Stiff loam, gravel subsoil.	Farmyard and cow manure.
155	Mr. R. Dobbyn	Ballynakill House, Co. Waterford	Clay	Stable manure, with bones and blood.
166	Mr. R. Glancy	Ferkhill, Granard, Co. Longford	Clay on limstone subsoil.	6 tons farmyard manure.
182	Mr. B. F. Eustace	Hillside Farm, Hampstead, Glasnevin.	Heavy clay, yellow subsoil.	40 tons farmyard manure.
183	Mr. J. Newenham	South Slob Lands, Wexford	Alluvial deposit	No manure.

Reference Number.	Duration of Growth.	Previous Crop.	Mette (German Seed), "Wanzleben."															Compared with F. O. Litch, Madgeburg.			
	Days.		Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of the Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of the Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of the Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.
173	164	Oats	613	20·70	2·20	90·39	19·80	....	....	....	....	....	....	....	....	....	....	580	16·75	3·15	84·17
			Vilmorin (French Seed), "Blanche."					Mette (German Seed), "Vilmorin."					Schreiber (German Seed), "Zuckerreiche."					Compared with F. O. Licht, Magdeburg.			
152	161	Pasture grass..	910	18·40	3·20	85·19	17·10	....	....	....	....	....	....	....	....	....	....	580	16·75	3·15	84·17
162	145	Potatoes	....	....	....	....	....	1023	19·10	2·70	89·61	18·20	810	18·00	2·90	86·12	17·10	580	16·75	3·15	84·17
			Schreiber (German Seed), "Zuckerreiche."					Vilmorin (French Seed), "Elite."					Mette (German Seed), "Wanzleben."					Compared with F. O. Licht, Magdeburg.			
127	152	Oats	1065	18·30	2·40	88·40	17·50	1429	17·30	2·30	88·26	16·40	....	....	....	....	....	580	16·75	3·15	84·17
128	180	Oats	....	....	....	....	....	931	16·30	2·60	86·24	15·70	820	17·30	2·90	85·64	16.50	580	16·75	3·15	84·17
129	180	Oats	1168	17·20	2·20	88·65	16·60	....	....	....	....	....	....	....	....	....	....	580	16·75	3·15	84·17
141	181	Spinach	1648	18·20	2·40	88·35	17·60	1349	16·90	2·70	86·22	16·20	....	....	....	....	....	580	16·75	3·15	84·17
155	180	Oats	....	....	....	....	....	1947	16·20	2·30	87·56	15·60	....	....	....	....	....	580	16·75	3·15	84·17
166	194	Mangolds	....	....	....	....	....	926	19·90	2·40	89·24	19·00	....	....	....	....	....	580	16·75	3·15	84·17
182	187	Potatoes	813	16·70	2·20	88·35	16·00	692	16·70	2·70	86·08	16·10	745	19·40	2·90	86·99	18·20	580	16·75	3·15	84·17
183	176	Oats	1130	19·30	2·40	88·94	18·40	....	....	....	....	....	....	....	....	....	....	580	16·75	3·15	84·17

THE SUGAR TEST FOR WATER.

By Dr. T. L. Phipson,

Formerly of the University of Brussels, and the Laboratoire de Chimie Pratique, Paris, &c.

During the past summer I have made a few observations upon the sugar test for water, and have applied it to a number of samples sent to my laboratory in London from various parts of the world. They appear worthy of publication.

The most difficult thing we have to contend with in the analysis of water intended to be used for drinking, is to ascertain the nature of the organic matters which all natural waters, even mineral springs, contain. It would be a great boon were anyone to discover a substance which, on being added to a sample of water, would indicate whether the organic matters it contained were, or were not, of a noxious quality—whether or not there were any sewage contamination.

It has been thought that we have such a substance in pure crystallised sugar (saccharose). The test consists in taking 150 ccm. of the water to be examined, and dissolving in it 0·5 gramme of pure crystals of sugar, closing the orifice of the flask with a good plug of cotton-wool, and exposing it to the direct rays of the sun for a few days, the temperature being about 80° Fahr. In a day or two, there will appear specks of a white flocculent vegetation, which will increase more or less during the next week or two. I have discovered that this test will take effect with all waters, however pure. It was successful with the purest waters I have received from Madeira and Scotland, with the water of the London water companies, and with that from various wells in different parts of the country. If the water, or water and sugar solution, be previously boiled, no result is obtained. If the sugar solution alone is boiled, the result is obtained.

This shows that the cause of the phenomenon is something contained in the water, certain germs, perhaps, that develop at the expense of the sugar, and that these are contained in all natural waters, however pure. All I can say, at present, is that the developement of the white flocculent substance is most rapid and most abundant in those waters which are the most impure, such as well waters, but it is no certain indication that there is sewage contamination. Under the microscope the white flocculent organism is found to consist of myriads of transparent oval cells, infinitesimally minute, and isolated, but secreting from their walls a gelatinous fluid which holds them together in flocks or colonies.

The Casa Mia Laboratory,
Putney, S.W.

CUBA.

Opening for Sugar Machinery.

By Gaston Descamps, Consulting and Manufacturing Engineer.

With the exception of some half-dozen factories which have become the property of American citizens, including the Central Factory "Trinidad," erected about five years ago, nearly the whole of the central factories in Cuba were fitted with machinery by European houses, English, French, German, and Belgian, so that it can scarcely be said that up to now American constructors have been in this market as regards *complete installations.* At the same time, in the sugar houses mounted by European engineers American machinery—such as boiling pans, centrifugals, and auxiliary or donkey engines—was introduced.

The United States have, however, been for many years really the monopolisers of the Cuban crops, having taken 90 per cent. of the sugar and a large portion of the tobacco and timber produced in the island, expending annually with us more than $50,000,000, and importing not more than $15,000,000 to $20,000,000, so that they have always had a balance against them of some thirty to thirty-five millions. How then can we explain the fact, that having to send to Cuba such a large sum in payment for their purchases, they have not succeeded in monopolising the market for their sugar machinery, and have in this respect remained in the hands of the European constructors?

There will be no want of people who will assert that the reason is to be found in the inferiority of American machinery, inasmuch as only last year, in the case of certain beet factories set up in the United States, the promoters of these gave the German machinists preference over the American constructors. But such reasoning would not be accurate, because everyone properly acquainted with the matter knows that in the United States there can be and is being manufactured very good sugar machinery, which at equal prices, is able to compete with the European production. In spite of the fact that one of the most important elements in every sugar factory, the multiple effect evaporating apparatus, was the product of the inventive genius of an American, Rillieux of Louisiana, whose invention dates from some fifty years ago, the construction of sugar machinery in the United States really only began to develop in this direction some

twenty years back. And although as a rule it is mainly a reproduction of European models, still it must be acknowledged that as far as the apparatus for evaporation and defecation are concerned, some genuine American types, based on new ideas, have been constructed, such as the "Yaryan," the "Lillie," for evaporation; and the "Deming" for clarification. There is therefore no reason for attributing to any inferiority of the American machinery the fact that it has not included a larger number of complete plants in Cuba, and the cause must be sought for in other directions.

Let it be remembered that the cost of a complete plant does not fall below $250,000 to $300,000, and that in order to secure a contract it is absolutely necessary that the constructor should arrange on the basis of payment by instalments. Again, contracts of this importance are not made all at once, like an ordinary sale of goods; in order to obtain them it is necessary that everything should be maturely considered, and above all thought out on the spot, the local conditions of each estate being taken into account so as to secure the best possible result. And it is because they have adopted this as a principle that the European constructors have succeeded in monopolising this market for their sugar machinery.

In fact, these machinery houses, whether English, French, or German, constitute large companies with important capital, able to carry out contracts for complete installations, on the basis of payment in terms of three, four, or five years, with interest varying between eight and nine per cent., and this interest secures to their shareholders a good dividend on the investment of their loose capital, which in Europe would scarcely bring them in 3½ per cent. And there is no doubt whatever that, but for this basis of arrangement for paying by instalments with the profits of the future crops, these central factories could not have been established or carried on. On the other hand, the large engineering firms, who wanted employment for their workshops, from which issued the machinery from mill down to centrifugal, were interested in promoting the movement, as they had sufficient capital at their disposal which they could thus place out at good interest and on good security, inasmuch as the plant remained their property until the last instalment had been paid.

Meanwhile, the American manufacturers, *each adhering to his own speciality*, were contented either with selling their machinery simply and expeditiously, for C.O.D. at the port of shipment, to export commission agents, or with sending out *drummers* who travelled

through the island during February and March, and generally with but poor success. Those who sold machinery in this manner took no account whatever of the conditions under which it had to be set up, or whether or no it would meet the requirements of the planter, the principal question being that of getting the orders, and this gave rise to numberless disappointments. Moreover, in order to allow a profit to two or three middlemen, the price paid by the planter came to double the original price of the manufacturer, for which reason, in order to secure a sale, they always ordered cheap machinery from the latter. This naturally could not turn out satisfactorily, and the planter then abused the maker whose name was stamped on the apparatus, while the two or three middlemen escaped scot free, having in reality realised, every one of them, as much profit as the manufacturer.

It is almost superfluous to say that for the new era which is now dawning on the country—which will need foreign capital more than ever—a wide field is being opened for the introduction of such capital, not in the form of specie but in the shape of machinery, which will secure employment for the engineers' workshops. It is both logical and probable to assume that the American makers will open their eyes and recognise the mistake which they have been making, and will modify their methods so as to be able to enter into full competition in the market. And it is absolutely necessary that the European manufacturers should not overlook the fact that they must be more than ever *on the spot*, and must have their own offices in the country, if they want to be able to compete and to maintain their supremacy. Some firms, such as Cail, Fives-Lille, St. Quentin, Sangerhausen, Krupp, and Koppel have been fully alive to this, and have kept their offices open in spite of the war. To secure the business which is now opening in connection with the rehabilitation of the factories, it will not be sufficient to have travelling engineers who merely come and take a trip during the cold season, it will be necessary to have permanent centres for creating or renewing connections regularly established in this market. Let those who are as yet absent accept this note of warning and bestir themselves.

The application of "Chapman's Circulators" in the factories of the Perak Sugar Cultivation Company, is stated to have largely increased the evaporating power of the Triple Effet.

Correspondence.

Government Laboratory, Georgetown,
Demerara, December 6th, 1898.

To the Editor of the "Sugar Cane."

Sir,—My attention has been called to a charge of discourtesy brought against me by Mr. Veley, on page 499 of the September number of the *Sugar Cane.*

Since my return to town from my geological expedition into the interior of the colony, I have searched through all the letters which I have received from Mr. Veley to find, if possible, the "request made to him personally to suspend judgment until the full publication of our results."

This I have failed to do; no such request having been made to me. The nearest approach to such a request appears in a letter dated September 18th, 1897, written in answer to one of mine in which I pointed out certain facts which, in my opinion, militated against the organism discovered by Mr. Veley being the sole cause of faultiness in rum. The paragraph in question is as follows:—

"We hope in the course of the next few weeks to publish an account of our experiments and results; meanwhile you will doubtless agree that any criticism of work as based upon reports sent to manufacturers at an early period of our investigation and of a private character, may be premature."

I read this as a kindly warning against my presuming to venture to hold an opinion on a subject to which I had devoted many years attention, after Mr. and Mrs. Veley had produced a theory which they evidently considered I and all others were bound to regard as infallible, simply because they were the authors of it.

Surely, on page 381 of the *Sugar Cane* Mr. and Mrs. Veley have published a sufficient account of their results to justify criticism. Any person reading the joint paper by Mr. Scard and myself will notice that our experiments therein detailed were directed to the points indicated in the note, and not against portions of the reports which were sent to manufacturers and which, very wisely in my opinion, Mr. Veley desires to regard as being of a private character. As a matter of fact, the manufacturers mentioned in our paper placed all the papers before the Agricultural Committee of the Royal Agricultural

and Commercial Society of British Guiana, and authorised me to make any use of them I considered right.

The effect of Mr. Veley's contention, apart from the baseless charge of discourtesy he has brought against me, is that an investigator who thinks he has discovered something of importance commercially may, by the publication of a notice of his results and a direct contradiction of the results of others' work, claim exemption from all criticism, and that until such time as he may see fit to publish what, in his own opinion, is a sufficiently full account of his results, his opinions and theories are to be regarded as infallible. In other words, the non-publication of his results and experiments is to amount to proof of their accuracy.

I have the honour to be, Sir,

Your obedient servant,

J. B. HARRISON.

NOTICE OF BOOK.

THE MICRO-ORGANISM OF FAULTY RUM. By V. H. Veley, M.A., F.R.S. and Lilian J. Veley (*née* Gould). London, Henry Frowde, Oxford University Press Warehouse, Amen Corner, E.C. 1898, pp. 64, with plates. 5s. net.

This extremely well got up little volume is dedicated to Dr. Emil Christian Hansen, the eminent professor at the Carlsberg Laboratory at Copenhagen, who has examined the material and the investigations from which the book is compiled. The authors state that they believe they have opened up a new field of research in connection with the micro-organisms of spirit distilleries, which had hitherto received but little attention, and have "spared neither time, labour nor expense to elucidate the problem of the faultiness of rum and to make known its solutions." The volume before us certainly commends itself even to a mere novice by the full detail with which the subject is treated and the exceedingly clear illustrations. It will be known to readers of *The Sugar Cane*, that some of the conclusions arrived at in the course of these investigations have been challenged by Professor Harrison, of the Government Laboratory at Georgetown, and Mr. Scard, the chemist of the Colonial Company in Demerara, and as the authors admit that Dr. Emil Christian Hansen, though confirming their results, did not quite agree with their "conclusions in their

entirety as to the identity or position in any scheme of classification of the organism or organisms discovered" by them, and further state "we are well aware that the life-history of the organism may continue for some time to be a matter of reasonable controversy" we feel that any attempt on our part to criticise in a matter so abtruse and yet so commercially and scientifically important, would be futile, not to say presumptuous. We therefore feel justified in leaving and commending the work to those experts who will not fail to deal with it, and to the large number of mercantile men practically interested in the phenomena which very vitally affect those concerned in the production and distribution of rum and similar distilled spirits.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; 322, High Holborn, London; and 118, New Street, Birmingham.

ENGLISH.—Applications.

21300. E. Shaw, London. *Improvements in apparatus for cooking, concentrating, and evaporating liquids.* 10th October, 1898.

21361. A. E. H. Loze, Liverpool. *Improved material for purifying, filtering, clarifying, and sterilizing liquids.* (Date applied for under Patents, &c., Act, 1883, sec. 103, 7th March, 1898, being date of Application in France.) (Complete specification.) 11th October, 1898.

21698. W. G. Heys, Manchester. (A communication by J. J. Heilmann, France.) *Improvements in steam turbines.* (Complete specification). 15th October, 1898.

22065. D. Young, Glasgow. *A centrifugal motor.* 20th October, 1898.

22788. G. B. Ellis, London. (A communication by F. Hornig, Germany.) *Improvements in the treatment of spent beetroot and production of a useful body therefrom.* 29th October, 1898.

22812. H. W. Cowley, Manchester. *Improvements in turbines.* 31st October, 1898.

23611. John Wilson, Glasgow. *A diluted or reduced standardised saccharine.* 9th November, 1898.

25463. JOHN J. MARSHALL, London. *Improvements in the method of and in apparatus for weighing granulated sugar and the like.* 2nd December, 1898.

25642. O. IMRAY, London. (A communication by Ranson's Sugar Process, Limited, France.) *Improvements in purifying and decolourizing saccharine liquors.* 5th December, 1898.

ABRIDGMENTS.

16292. E. W. GERBRACHT and F. G. WIECHMANN, New York. *Purification of saccharine juices or sugar solutions.* 26th July, 1898. This invention relates to a process for purifying saccharine juices or sugar solutions from whatever source derived. In a prior application, No. 29630, 1897, a process was decribed for treating black-strap, which consisted in introducing into the solution to be treated sufficient of a suitable alkali to give the sugar an alkaline reaction, then boiling in vacuo to expel the volatile alkaline products, then adding sufficient of a suitable acid to neutralise the alkali previously added and leave a free acid, and finally again boiling in vacuo to expel the volatile acid products. This invention differs from the above in that, instead of using first an alkali and then an acid in connection with a vacuum apparatus, low temperature and low pressure, a chemical substance is made use of, such as salt, for nstance, mono-calcium hydrogen phosphate, $CaH_4 (PO_4)_2$, or other suitable salt, such that when it is introduced into the saccharine solutions, and the solution boiled in vacuo under low temperature, it is decomposed into an alkaline salt and an acid and expels the volatile alkaline products, as well as the volatile acid products contained in the solution acted upon.

24383. HARRY MACHIN, London. (A communication by Edward A. Dix, Government Tchernigoff, Russia.) *Manufacture of sugar and an apparatus therefor.* 21st October, 1897. In carrying this invention into effect the sugar "fillings" (such as are used for filling the forms or moulds in the ordinary manufacture of best loaf sugar), are poured into the spaces formed by a series of pliable perforated frames, which are placed on edge sideways in a zinc tank or box-like receptacle, so arranged and tightened together by a wedge that the spaces form a series of grooves. The grooves are square in cross section, and the "filling" therein subsequently form sticks or prisms of sugar, which are afterwards broken up into the well known cube sugar. The mass of "filling" is of any required consistency and concentration, and on pouring it into the zinc tank it fills the frames or prism spaces per-

fectly, owing to the perforations in the back of the pliable frames allowing the air to escape readily. In about eight hours the mass is usually sufficiently cool and hard to permit the withdrawal of the wedge, on which the pliable perforated frames are loosened, and sometimes placed in the bath of liquor.

24593. DÉSIRÉ LOISEAU, Paris. *Processes of purifying and clarifying sugary products in sugar-houses, sugar and molasses refineries, refineries or factories of glucose and the like.* 23rd October, 1897. The inventor claims in this invention:—1. The new double combination of bibastic sucrate of hydrocarbonate of lime and carbonate of lime, the composition of which answers to the formula $C^{12}H^9O^9 2$ (CaO HO) (CaO CO^2) 2 (CaO CO^2). It is optional on his part to obtain this product by any means. 2. The method of manufacturing the hydrated crystallized carbonate of lime, as specified in the patent. 3. The application of the bibastic sucrate of hydrocarbonate of lime and of carbonate of lime to be employed alone, or to be employed in conjunction with crystallized hydrated carbonate of lime, for the purification of the various sugary products (juice, syrups, raw sugars, etc.) 4. The applications of the crystallized hydrated carbonate of lime to be used alone or with the sucrate $C^{12}H^9O^9$, 2 (CaO CO^2) (CaO HO^2) 2 (CaO CO^2) for the purification of the various sugary products and as adjuvant to the other calco-carbonic purifying processes, especially when sugary products rich in glucose are being treated for purification, without destroying the glucose. 5. The method of purifying juice, as specified in the patent and which consists in making calco-carbonic sucrate with a portion of the juice strongly limed and in using it in mixture with another portion of the juice unlimed or very feebly or weakly limed.

25081. HEINRICH BERTRAND and WILLIAM KNECHT, both of Worms. *Improvements in filtering apparatus.* 29th October, 1897. The object of the present invention is a filter-press in which thoroughly dry filtering material can be used instead of wet material. In consequence of this new arrangement the new filter-press has the advantage of greater cleanliness and of being put into operation with greater rapidity. When such a press is employed in various industries such as sugar refining, brewing, etc., a preliminary vessel or preliminary filter is quite unnecessary as filtered liquid can be run off at once which is not the case in any of the systems hitherto known. Moreover, all loss of liquid is entirely prevented. This dry filter apparatus is characterised by having a copper holder capable of turning

on bearings of a portable framework with fixed frames supporting perforated plates and the filtering material, also an inspection glass with testing cock and pressure guage into which holder the pipe coming from the first inspection glass opens, while the outlet pipe in provided with a third inspection glass and an exit cock.

2970. CHARLES MALLINSON, Liverpool. *Apparatus for conditioning and drying grain, berries, sugar, seeds, crystals, and granular and pulverulent material generally.* 5th February, 1898. This invention relates to an apparatus for conditioning and drying grain, berries, sugar, seeds, crystals, and granular and pulverulent material generally, into which the produce or other material (after being washed, drained or otherwise treated) is placed and falls by gravity in contact with steam or hot water or air pipes.

UNITED STATES.—ABRIDGMENT.

612319. B. EBA, Warren, Pennsylvania. *Bone-black kiln.* October 11th, 1898. This invention relates more particularly to that class of apparatus or kilns for calcining or revivifying bone-black wherein the retorts supplied with the bone-black from a feed hopper are in communication at their lower ends with perpendicular cooler cylinders, which cool the bone-black sufficiently to enable it to be safely discharged in contact with the atmosphere.

613892. WILLIAM E. SHOALES, of Plymouth, New York. *Evaporating pan.* November 8th, 1898. This invention relates to evaporating pans in general, and while the devices comprised in the invention are adapted especially to that class of evaporating pans used in the manufacture of maple-syrup from sap, they are capable of use with any and all syrup evaporators. The object of this invention is to provide evaporating pans with improved devices for drawing off the syrup as fast as made, which drawing-off devices shall be automatic in their actions, being operated by the syrup itself, whereby the syrup cannot remain long enough in the pans to be burned or to cause damage to the evaporator, and when the supply of sap is kept up will operate continuously without attention.

614764. HERMAN DE VRIES ROBBÉ, Amsterdam, Holland. *Continuous centrifugal separator.* November 22, 1898. This invention relates to centrifugal separators, such as are used in the sugar industry for the purpose of separating the sugar crystals from the syrup and in which the action is continuous. The objects of the invention are to reduce as far as possible the labour of handling the material to be operated upon, and to simplify and increase the

efficiency of the machine as compared with others of the same class. With these objects in view the separator is arranged so that the material to be dried is continuously fed in at the top thereof, passes through the machine in one direction only, and after having been dried passes out through the open bottom of the separator and falls directly into a suitable receptacle.

GERMAN.—ABRIDGMENTS.

98390. G. FLORACK, Düsseldorf. *Rotary filter drum.* 22nd August, 1897. A filter drum of the usual construction is so connected, as a preliminary filter with two subsequent filter drums, to the same longitudinal hollow shaft, that the liquid entering the preliminary filter from the outside is again discharged through one of the subsequent filters from the inside. An adjustable pipe is arranged on the shaft, and is provided with holes, by means of which the connection of the filters with the hollow shaft can either be made or broken. Means are provided for cleansing an already used filter.

98682. R. BERGREEN, Roitzsch, nr. Bitterfeld. (Addition to Patent No. 96677, 1896.) *Process for separating crystals from the drainings from the manufacture of sugar.* 2nd February, 1897. According to the principal patent, a degree of heat of at least 85° is preserved for some time in order to diminish the viscosity (toughness or stickiness) during the supersaturation of the sugar solutions by concentration, but this latter method is now superseded by adding lime or any other basic body for the same purpose.

98710. W. IBJANSKI, Sielce, near Sosnowice, Poland. *Process and apparatus for attaining a periodic backward and forward movement of the juice in evaporators and the like.* 11th December, 1897. By periodically creating an over pressure in the one part of an evaporator, separated in two parts, which communicate the one with the other, the juice is forced into the other part, out of which, on the over-pressure ceasing, it again flows back. The evaporator is divided by a partition into two chambers, which communicate the one with the other. In the one chamber arrangements for provided for the discharge of the vapour; the other chamber is also provided with similar arrangements connected by a pipe. A valve is also provided in connection with the arrangements for the discharge of the vapour in the first chamber which is so arranged as to close in a lateral direction. If this valve be closed, the pressure in the last named chamber rises and presses the boiling juice through the opening which communicates with both chambers into the first named chamber. If the valve be

closed, the pressure in both the chambers becomes equalised and the juice then flows back to the last named chamber. Thus by this periodical opening and shutting of the valve a continuous backward and forward movement of the juice between the two chambers is attained.

98940. RANSON'S SUGAR PROCESS, LIMITED, London. Patent of addition to Patent No. 95204. *Process for bleaching sugar juice by means of oxidising and reducing substances.* 30th December, 1896. The process, covered by claims 1 and 3 of Patent No. 95204, is modified by introducing into the juice, which has been neutralised by treatment with sulphurous acid, rnd then with a sufficient quantity of oxidising substance to convert the sulphite into sulphate, repeated doses of sulphurous acid, in order to release the organic acids in the juice, and then reducing the sulphurous acid to hydro-sulphurous acid by means of zinc dust, the colouring constituents being destroyed by reduction.

98445. KARL ABRAHAM, Kiew, Russia. (Addition to Patent No. 98035, 22nd January, 1897.) *Process for preventing the formation or re-dissolving of fine crystals in vacuum.* 7th August, 1897. The arrangement already described under Patent No. 98035 of movable shut-off arrangements or fixed insertion pieces in the vacuum boiling apparatus for avoiding the circulation of the mass, and preventing the formation of the fine crystals, has been extended in order that to apply to the case, in which the varying adjustment of the working is to be replaced by a constant one. In the latter case the movable insertion pieces can be used with the fixed ones. In order also to prevent the formation of fine crystals, roof-shaped shields can be made use of, which are fixed over casing at a small distance apart, and provided with openings. Or, to serve the same end, heating bodies can be arranged in those parts where an undesirable increased current is to be looked for.

98932. H. KRÖGER, Röszgen, near Mittweida. *Underneath manhole fastener for a diffuser.* 6th October, 1897. The cove of the manhole is attached to a band, which revolves round pivots, and is provided with a counterweight. In order to be able to open and close the cover from the upper foot floor, a screw spindle with a hook, guided by a rod and a sliding piece connected with two rails, which move up and down down the spindle, are made use of. The screw spindle is guided in a T-shaped piece with the aforesaid guiding rod and a catch lever. If the spindle be turned by means of the lever, the hook descends at the same time with it, and is drawn simultane-

ously by means of the guide rod to one side, thereby freeing the band of the cover, thus the latter, in consequence of the pressure of the liquid in the diffuser, opens. At the same time the sliding piece with rails slides down upon the spindle and sets in action the catch lever which maintains the cover in an open position.

99441. R. Fölsche, Halle a/S. *Process and apparatus for crystallising out the after-product of masse-cuites.* 25th September, 1897. After-product masse-cuites, especially those which are not capable of being any longer converted into grain, are placed in a high column and left to rest. The sugar crystals separated out sink slowly down by the gradual increase of their weight, and thus a separation of the crystals according to their size and weight is automatically accomplished, so that in the lower layers only the largest and heaviest crystals are present. The mature crystallised masse-cuite is then from time to time withdrawn, and the intermediate spaces filled with fresh material. The column-shaped vessel is about 12 metres in height and is provided in its lower part with stirring apparatus, for furthering the withdrawal of the material, which is brought about by means of a slide groove. A perpendicular partition is placed over the stirring apparatus, in order to prevent the material in the upper part from revolving.

99385. H. Putsch & Co., Hagen i. W. *Apparatus for pressing beetroot and the like against the cutting cylinder of shredding machines.* 11th November, 1897. In order to guard against the roots, during the centrifugalling, escaping the cutters of the beet shredding machines, groups of single cylinders are fixed so as to revolve upon their avis over the knife cutting disc of the shredding machines, the edges of these cylinders being either serrated, plain or pointed, or instead of the latter rotatable toothed cylinders can be so arranged that the roots are caught between the latter and the shredding cylinder and so prepared for the action of the cutter.

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To end of November, 1897 and 1898.

IMPORTS.

Raw Sugars.	Quantities.		Values.	
	1897.	1898.	1897.	1898.
	Cwts.	Cwts.	£	£
Germany	3,915,930	5,296,560	1,713,586	2,417,296
Holland	152,514	267,555	64,329	115,179
Belgium	1,090,452	1,222,992	466,912	560,431
France	2,445,269	1,921,012	1,164,514	965,339
Java	417,445	493,345	202,107	246,006
Philippine Islands	709,211	897,280	268,758	398,684
China, Hong Kong, &c.	200	....	130	....
Spanish West India Islands	21,320	14,380	11,046	8,108
Peru	724,414	931,022	363,304	472,673
Brazil	256,487	428,577	112,238	203,432
Mauritius	48,619	62,310	20,903	31,513
British East Indies	547,252	399,570	192,041	172,824
British W. Indies, British Guiana, & Brit. Honduras	928,501	818,297	573,661	502,774
Other Countries	806,080	812,711	371,162	388,355
Total Raw Sugars	12,063,694	13,565,611	5,524,691	6,482,614
Refined Sugars.				
Germany	9,033,780	9,799,670	5,493,728	6,017,681
Holland	1,595,672	2,115,944	1,069,043	1,365,046
Belgium	702,267	418,238	437,088	262,996
France	2,925,792	2,148,227	1,771,801	1,318,415
United States	13,243	7,777	13,420	8,456
Other Countries	12,948	47,647	7,868	27,811
Total Refined Sugars	14,283,702	14,537,503	8,792,948	9,000,405
Molasses	1,089,016	1,188,046	228,096	306,770
Total Imports	27,436,412	29,291,160	14,545,735	15,789,789

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden and Norway	91,478	94,926	53,853	56,510
Denmark	130,587	117,763	66,811	60,562
Holland	106,186	104,873	58,485	59,496
Belgium	16,696	16,571	9,188	9,488
Portugal, Azores, &c.	94,098	70,707	50,372	38,249
Italy	51,293	35,354	26,970	18,985
Other Countries	312,704	226,848	171,065	130,580
	803,042	667,042	436,744	373,870
Foreign & Colonial Sugars.				
Refined and Candy	191,239	169,095	119,573	104,987
Unrefined	395,862	325,364	209,404	179,468
Molasses	256,664	273,926	88,073	83,577
Total Exports	1,646,807	1,435,427	853,794	741,902

MONTHLY PRICES OF STANDARD QUALITIES OF SUGAR DURING 1898.

	London.			New York.	
	Beet 88°/o.	West Indies.	German Granulated.	Fair Refining.	96% Centfs.
January	9/6	8/9	11/1½	3⅝c.	4 3/16c.
February	9/0	8/6	10/9¾	3 11/16c.	4 3/16c.
March	9/3½	8/6	11/0	3½c.	4 1/16c.
April	9/0	9/3	10/9	3⅝c.	4⅛c.
May	9/5	9/6	11/3	3¾c.	4¼c.
June	9/9	10/0	11/5¼	3¾c.	4 5/16c.
July	9/6	10/0	11/0	3½c.	4⅛c.
August	9/3	10/0	10/9¾	3¾c.	4¼c.
September	9/6	10/3	11/4½	3 13/16c.	4⅜c.
October	9/7½	10/6	11/9	3 11/16c.	4 3/16c.
November	10/0	11/0	11/7	3 15/16c.	4 7/16c.
December	9/9	10/6	11/0	3⅞c.	4⅜c.
Average	9/5½	9/8½	11/2	3¾c.	4¼c.

UNITED KINGDOM.

Statement of Eleven Months' Imports, Exports, and Consumption for Three Years.

	1898. Tons.	1897. Tons.	1896. Tons.
Stock, 1st January	90,000	139,623	110,184
Imports, Raw Sugar, Jan. 1st to Nov. 30th	678,280	603,185	720,835
,, Refined, Jan. 1st to Nov. 30th	726,875	714,185	669,840
,, Molasses, Jan. 1st to Nov. 30th	59,402	54,451	34,206
	1,554,557	1,511,444	1,535,065
Stock, in 4 chief Ports, Nov. 30th	72,000	68,062	136,647
	1,482,557	1,443,382	1,398,418
Exports (Foreign, and British Refined)	71,771	82,340	77,345
Apparent Consumption for Eleven months	1,410,786	1,361,042	1,321,073

Stocks of Sugar in Europe at uneven dates, December 1st to 20th, compared with previous Years.

In thousands of tons, to the nearest thousand.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	Total 1898.
77	870	527	522	169	2165

	1897.	1896.	1895.	1894.
Totals	2129 ..	2184 ..	2215 ..	1506

Twelve Months' Consumption of Sugar in Europe for Three Years, ending 30th November, in thousands of tons.

Great Britain.	Germany	France.	Austria.	Holland, Belgium, &c.	Total 1897-98.	Total 1896-97.	Total 1895-96.
1634	732	523	353	448	3690	3705	3408

Estimated Crop of Beetroot Sugar on the Continent of Europe for the current Campaign, compared with the actual crop of the three previous Campaigns.

(From Licht's Monthly Circular.)

	1898-99.	1897-98.	1896-97.	1895-96.
	Tons.	Tons.	Tons.	Tons.
Germany	1,710,000 ..	1,852,857 ..	1,836,536 ..	1,615,111
Austria	1,000,000 ..	831,667 ..	934,007 ..	791,405
France	800,000 ..	821,235 ..	752,081 ..	667,853
Russia	750,000 ..	738,715 ..	714,936 ..	712,096
Belgium........	220,000 ..	265,397 ..	288,009 ..	235,795
Holland........	155,000 ..	125,658 ..	174,206 ..	106,829
Other Countries..	155,000 ..	190,000 ..	202,990 ..	156,340
	4,790,000	4,825,529	4,902,765	4,285,429

It will be observed that, as compared with the preceding month, the estimates are increased, viz., for Austria by 190,000 tons; for France by 60,000 tons; for Belgium by 30,000 tons; for Holland by 5,000 tons; a total of 285,000 tons; and decreased by 40,000 tons for Russia, and for "Other Countries" by 15,000 tons. The net increase is thus 230,000 tons, and was totally unexpected.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

Quietness and abstention characterised the first week of December, both as regarded English and United States buyers. Holders of cane as well as beet sugar were firm, and little disposed to offer, so that transactions were very moderate.

The event of the month was the totally unexpected increase in the estimates of the European beet crops by more than 200,000 tons, the Austrian figures alone showing an advance of over 180,000 tons, and this unlooked for event produced a temporary disorganisation, which affected the market up to Christmas. No one was willing to operate, excepting for immediate wants, and the American demand totally ceased for the time. The result has been that the advance secured in November was quite lost, excepting in the case of Madras sugar, in which a larger deficiency than was expected seems likely.

In cane sugars but little has been done, and that only at lower quotations. Foreign granulated is also for the moment especially low.

The great discrepancy between this last estimate of the Austrian production and the figures till lately accepted by all statisticians is difficult to account for, and leads to some doubts as to the good faith of the information previously supplied. After all, the statistical position is not fatally weakened, as the probable total quantity of all sugars is still somewhat below that of last year at this time. At the moment of writing there is a slight improvement.

The following quotations are in all cases for prompt delivery :—

			Last Month.
Porto Rico, fair to good Refining	10/3 to 11/6	against	11/0 to 12/0
Cuba Centrifugals, 97°/。 polarization....	11/6	,,	12/0 to 12/3
Java, No. 14 to 15 D.S.	11/9	,,	12/3
British West India, fair brown	10/3 to 11/6	,,	11/0 to 11/6
Bahia, low to middling brown	9/3 to 9/9	,,	9/3 to 10/6
,, Nos. 8 and 9..	9/6 to 10/0	,,	10/3 to 10/9
Pernams, regular to superior Americanos.	9/9	,,	9/9 to 10/0
Madras Cane Jaggery..	9/3	,,	9/3 to 9/6
Manila Taals	8/3 to 8/6	,,	8/9
French Crystals, No. 3, f.o.b.	11/0 to 11/3	,,	11/6
Russian Crystals, c.i.f..	11/0 to 11/3	,,	11/9
German granulated, f.o.b.	11/0	,,	11/7
Tate's Cubes..	15/7½	,,	15/10½
Beet, German and Austrian, 88%, f.o.b...	9/7½	,,	10/2

THE

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The honour which has been conferred on Mr. Nevile Lubbock, Chairman of the West India Committee, by his nomination as Knight Commander of the Order of St. Michael and St. George, as an acknowledgment of his long and valuable services in connection with the West Indian Colonies, has been a source of sincere gratification to the numerous friends and well-wishers of that gentleman, who have had opportunity to recognise and appreciate his continued and unwearied exertions in endeavouring to promote the true welfare of that portion of the Empire. It is hoped that this official recognition may be taken as an indication that the Government are intending to take this most pressing question of the regulation of the West Indian matters more seriously in hand.

The correspondence between Sir Nevile Lubbock and the Editor of the *Deutsche Zuckerindustrie* is still proceeding. A further instalment will be found in the present number, and another letter (copy of which is before us), is awaiting Dr. Hager's reply, and will appear, with a translation of the eventual rejoinder, in our March issue. A friend who is intimately acquainted with the whole subject, writes that he fails to see any opening for argument on the original question, inasmuch as it is manifest that whenever German raw sugar enters the United States it must be at a price of 1s. 3d. per cwt. below the

price of similar sugar which pays no countervailing duty. This is a simple fact, on which there cannot be two opinions.

Sir Nevile Lubbock, K.C.M.G., and Sir Cuthbert Quilter, Bart., M.P., are now in the West Indies making enquiries in regard to a scheme of setting up Central Factories, and we learn that so long ago as last May, Mr. Duncan Stewart, of the well-known Glasgow firm of D. Stewart & Co., Limited, Engineers and Sugar Machinery Makers, addressed a letter to Mr. Chamberlain, in which the whole question of the establishment of Central Factories was thoroughly worked out. The proposals laid before Parliament by Mr. Chamberlain, and agreed to last session, must to some extent have been the outcome of this proceeding, and we now hear, through the *Demerara Chronicle*, that the same firm is in negotiation with a number of Jamaica planters with the view of the eventual establishment of a Central Factory in that island. We hope to give some details on this subject later on.

On the 7th January the first Agricultural Conference in connection with the new Imperial Department of Agriculture for the West Indies was opened at Barbados, delegates being present from all the islands and from British Guiana. Dr. Morris, C.M.G., delivered an address on the objects of the Department, and at subsequent sittings papers bearing on different questions connected with the sugar and other industries were read by the delegates, and discussion took place.

Messrs. Blyth Bros. and Co., Mauritius, give shipments of sugar from 1st August to 23rd December, 1898, as 85,458 tons, against 54,120 tons during the corresponding period of last year. The principal feature is again the export to the United States, which reached 10,675 tons against 628 tons in 1897.

The present number contains a short account of the proceedings at a meeting of the Anti-Bounty League held in London on the 9th January, together with a letter addressed to Lord Salisbury by the British Refiner's Committee, and we have just received, too late for insertion, a copy of a further letter urging on Lord Salisbury "the necessity of making such provisions in new Commercial Treaties as will enable H.M.'s Government to surmount the only remaining practical obstacle to the abolition of the Bounties," constituted by the at present existing most-favoured-nation clause in those treaties,

which, in the opinion of the Law Officers of the Crown, precludes us from giving the security asked for by foreign governments as a condition of their agreeing to abolish bounties. This letter will appear in our March number.

We have pleasure in calling attention to the opening, on the 1st March, of the 28th session of the Brunswick Sugar School, which, notwithstanding the establishment of many other similar institutions, maintains its supremacy as the most cosmopolitan college in the world for instruction in matters relating to the sugar industry. Germans, Dutchmen, Russians, Austrians, Belgians, Swedes, Americans, Britons, etc. (to the total number of 1040 since its commencement), have profited by the practical and thorough course of teaching obtainable. Address: "Direction der Schule für Zucker-Industrie," Brunswick, Germany.

Messrs. Willett & Gray state that the consumption of sugar in the United States for 1898 amounted to 2,047,344 long tons. The price averaged ¼d. per lb. higher than 1897. The figure of consumption for 1898 falls below that for 1897, but this does not necessarily mean a decrease in actual consumption but only in distribution.

1898.

(*Completed from page 16.*)

In the beet growing countries of Europe the results of the year were on the whole favourable, and as far as figures are available good profits have been realised, especially in Russia and Sweden. The quality of the roots, as regards saccharine content, and consequently the weight of beets necessary to produce a given weight of sugar, has been improved. In Germany the quantity of beets required for the unit of sugar was 7·78, which was only surpassed in 1895. In France the quantity (*i.e.*, weight) of beet required was much below that of last year. In Austria the weight was about the same as that of the previous year, but a much smaller quantity of beets was produced in 1897-98 than in 1896-97. In France the tendency to decrease the number of factories and increase the individual capacity continues. In Russia, thanks to special fiscal legislation, the sugar industry is in a very prosperous state, and is, as regards equipment and the use of

modern processes, very little if anything behind its neighbours. The area under beet cultivation is increasing, and nearly thirty new factories are already in hand or projected, with every probability of being carried out. The saccharine content of the Russian beets is frequently unusually high, the average polarisation at one factory last year was nearly 18°, which probably exceeds any average hitherto known in any country in actual working, though cases of 21° are said to have occurred in actual working in Germany this year. The profits realised are on the whole much beyond the average of those obtained in any other country. In most other European countries the beet industry is progressing steadily, as for instance in Belgium, Roumania, Italy, and Servia. In Sweden it has retrograded, the production having been pushed beyond the consumption and there being no export premium. The farmers, discouraged by a poor cultural yield and an inadequate share of the profits, planted a less area. The sugar content of the 1898 beets was good, hence the factories have done well. In Italy the increased production is considerable; a new factory is to be set up near Bologna, and one at Segni, and these with the four existing establishments will nearly suffice for the present consumption of the country. Notwithstanding the failure of the factory at Monthey (Switzerland) some little time ago, it is possible that another will be erected at Aarburg (with government support) in the course of the present year. In Spain the loss of their West Indian Colonies and of the Philippine Isles will naturally lend a great impulse to the development of the native sugar industries both beet and cane, especially the former, and several new projects are being considered. It is worthy of remark that the Spanish cane sugar industry dates from considerable antiquity.

The efforts which have now for some time been made to bring about in Germany a union of those interested in the production of sugar, similar to that existing and working so well in Austria, appear likely to come to a definitive result before long. It will be remembered that the idea is to unite the two existing syndicates, those of the raw sugar manufacturers and of the refiners, in one representative body which shall work for the mutual interests of both. The working of the "contingent" regulations still gives rise to great dissatisfaction in Germany; the amount fixed as the total production for 1898-99 is put at a little over 1,830,000 tons; it is not the fixing of the total figure, but the distributing of it in the amounts allotted to

the individual factories, that causes discontent, and the regulations will probably have to be altered.

The French Antilles do not appear to be prosperous as regards their staple industry; their production remains stationary, and in Guadeloupe what we in this country regard as a most serious economic mistake has been made, in tripling the export duty on sugar and doubling that on molasses. In Martinique, however, active and practical steps are being taken in the direction of setting up experiment fields in connection with cane cultivation, such as have existed for some time in the West Indies, Java, Mauritius, and New South Wales. New varieties of canes for the purpose of experiment have been purchased in Trinidad and in British Guiana, and the necessary preparations have been made for a scientific study of manufacturing processes connected with sugar and alcohol. It is to be hoped that these valuable operations, which are at present being conducted by a special branch of the Botanic Gardens' Committee, will not be allowed to languish for want of proper pecuniary support. The results will not be immediately apparent, but in the end will prove well worth the needful sacrifices.

As regards the beet sugar industry in North America, the best that can be said of it is that in the United States there exists an extraordinary confidence in its future triumphant success. The production this year has fallen somewhat below that of last, but certain companies have paid large dividends, and factories are being projected and springing up almost everywhere. The initial difficulties of the starting of a new industry such as this are inevitably great, and it is hardly worth while to count up the few failures and mistakes that have taken place up to now, but a much more serious consideration than anything of that kind, or even than the unnatural, artificial "booming" of new enterprises, is the threatened influx of cheaply produced cane sugar from the new possessions.

It must not be forgotten that the history of the beet sugar industry in California dates from 1870, and that it was only after repeated failures that success was achieved in that State apparently so favourable for beet growing, but earlier efforts in other parts resulted in disastrous failure, so that the industry in the United States can as yet only be considered as in its infancy. Whether the infant be strong enough to survive the attack of the Hawaiian and Cuban and Philippine competition under the new circumstances, remains to be

seen, but the possibilities of the situation might well discourage anyone but an American or a Scotchman.

The area under cultivation has rapidly increased during the last four years, and may be taken approximatively as 23,000, 37,000, 45,000, and 60,000 acres respectfully.

The number of factories at present established, omitting the Wisconsin Beet Sugar Co. (in liquidation), is fifteen, of which those at Watsonville, Chino, Alvarado, Los Alamitos, and Crockett, all in California, are far the largest, while the three in construction are also in that State, one of them being that at Salinas, the capacity of which is three times greater than the largest hitherto erected there. California enjoys the advantage of its climate allowing the factories to work a greater number of days than is possible in other States.

The question of the value of sugar as food has received special consideration during the past year in Germany and France. In the former country experiments made by the army doctors proved conclusively the great influence of sugar in appeasing hunger and thirst, preventing physical exhaustion and adding to the muscular force and general wellbeing of the soldiers, and the result has been that sugar will henceforward form a much larger part of the army rations than hitherto, especially during forced marches and in time of active operations. For some years Professor Chauveau, of Paris, has been making careful experiments on the value of sugar as compared with flesh-meat, and the results as published in the autumn of last year indicate beyond doubt, not only that it is absolutely more than four times as effective in regard to the production of muscular force, but that a very large quantity can be absorbed by the animal economy without any unpleasant consequences and even with an increased efficiency of all the vital functions. It has also been shown that the consumption of even excessive quantities of sugar does not lead to the direct setting up of diabetic symptoms, the excess sugar being got rid of in the urine in the form of sucrose and not of glucose, which is the form in which the sugar is excreted by diabetic patients. Can there be stronger arguments than these for getting rid of the ridiculous and excessive imposts which stand in the way of any increase in the consumption of sugar in the beet growing countries and compel them to find a market for their surplus production by the evil and antiquated system of bounties on export?

This brings us to consider the question of saccharine, *i.e.*, the artificial product from coal-tar residua. During the year under review

measures have been passed in Germany, Austria, and Russia, for the restriction of the sale of this useless (from an alimentary point of view) if not noxious addition to articles of food. The Austrian legislation has been successful, and this and all other similar substances are now only drugs, the sale of which in that country is subject to restriction much in the same way as poisons, special authorisation being required for their importation and for their use in pastry making and confectionery. In Germany, where the use of these substances is forbidden (since 1st October, 1898) in the manufacture of beer, wine, liqueurs, syrups, preserves, &c., but where they are still allowed to be sold by druggists, their use for sweetening coffee, &c., is increasing. Further legislation will doubtless follow, as the consumption has more than doubled during the past twelve months, and is calculated to have replaced, in that period, about 35,000 tons of true sugar. In Russia the importance of saccharine, &c., is now only allowed under a special official permit. It is exceedingly likely that the total prohibition of the sale of saccharine, excepting under medical prescription, will eventually be adopted.

The production and use of glucose and similar articles has of late years greatly increased, owing to there being in most countries no inland duties on these competitors of sugar, which on the contrary is subject to heavy taxation. In France the consumption of glucose in brewing, in which case it is exempt from duty, has nearly doubled during the last fifteen years. The United States are now the principal producers of the various forms of glucose and brewers' sugars. The use of glucose in the manufacture of the article known as "Golden Syrup" which has for many years superseded the use of the old "treacle" in the United Kingdom, has recently been brought prominently under notice by the conviction of a London grocer for selling golden syrup composed of only 15 % of cane syrup and 85 % of glucose. This is held to be a fraud on the consumer, as golden syrup should be made from cane sugar only, and as the appeal has been abandoned, the decision, which caused some surprise, must for the present be regarded as correct. Considering that the nutritive value of glucose is much below that of cane sugar, the decision is greatly to the advantage of the consumers of this article, who are mostly of the poorer class.

It is satisfactory to find that the question of the purchase of canes according to their saccharine content is being taken into consideration in some quarters where canes are still bought almost entirely by weight. It may seem hardly credible, but such is the fact, that in Louisiana,

on the Egyptian Daira Sanieh estates, and in most parts of Queensland, where cane is purchased from small growers, such a ridiculous system, which offers no inducement for the production of high-class cane, should be in force. Now that the attention of those most closely interested has been awakened to the evil, an immediate change in this respect may be confidently looked for.

[We are compelled to reserve until next month some remarks on new processes of manufacture, and new phenomena in connection with cultivation.]

CRYSTALLISATION OF MASSE-CUITES FROM AFTER-PRODUCTS.

(Translated from the *Chemiker-Zeitung.*)

A paper by Dr. Claassen on the above subject, which also has appeared in the *Zeitschrift für Rübenzuckerindustrie*, is summarised by the *Chemiker-Zeitung* as follows:—

"The writer first of all contends that there is not and cannot be any such thing as *normal-molasses*, inasmuch as not only the quantity but also the quality of the non-sugars has a great influence in their production. Molasses is that final product, which, all conditions favourable to crystallisation being observed, on further concentration and being left to crystallise, will not yield any more sugar. The author disputes the assumption that besides the chemical theory of the formation of molasses a mechanical theory (by viscosity) can be held to exist, or considers it only possible in very exceptional cases. The viscosity only retards the crystallisation but does not prevent it, and on the other hand poor syrups crystallise out no more abunduntly under conditions which greatly diminish the viscosity, for instance, at high temperatures. The conditions of good and quick crystallisation are:—1. A sufficient quantity of crystals to promote crystallisation. 2. The right temperature. 3. Proper concentration. In order at every stage of crystallisation to have the smallest possible quantity of viscous mother-syrup the temperature must be kept sufficiently high, and care must be taken to have tbe least possible supersaturation of the syrups. Moreover, the saturation point of the syrups and molasses must be known.

"Experiments which the writer (in default of any already existing) made on both a small and large scale with regard to this showed that the mother-syrups of the 1897-98 campaign had a saturation-coefficient of about 1·3, the purity of the molasses being about 58°,

and the temperature of crystallisation 40°C. Under these conditions (under different conditions the coefficient may vary somewhat, which must be ascertained) the final after-product masse-cuite, will have to be so concentrated that after all sugar has crystallised out a mother-liquor shall remain containing, dissolved in 100 parts of water, 1·3 times as much sugar as a pure sugar solution saturated at a like temperature. Accordingly, the composition and concentration of a true molasses can be calculated for a given final temperature of crystallisation (30° to 80°C.), and from this again the right concentrations (as regards the quantity of water) and sugar content of the after-product masse-cuite itself, and thus again the real and apparent purities can be laid down. For both these cases the writer has calculated tables indicating at once the correct Brix content for various purities (55 to 76) and the final temperature of crystallisation (40° to 80°), which can be practically controlled, for example, by using Curin's Brasmoscope, and by these one can be guided as regards the concentration. The surrounding conditions (crystallisation in tanks, in pugmills, or *in vacuo*) must naturally be taken into account, and the concentration must mostly be kept $\frac{1}{4}$ to $\frac{1}{2}$% Brix higher, to make up for variations of the saturation-coefficient. Comparative experiments with after-products afford practical proof of the value of proper concentration, which is essentially evident when treating poor syrups with a purity below 62 to 63; with better syrups the principal advantage does not consist in a better extraction of sugar, but in the obtaining of better (purer, larger grained) sugars."

MODERN POLARISCOPES.

By Geo. Stade.

In the present day a thorough rigorous control is exercised with regard to everything in connection with sugar, not only in the factory but also in the field, and in commercial dealings. The check maintained over the work done in sugar works and refineries extends, in well-managed concerns, to the minutest details, and even a difference of a few tenths of saccharose in the *rendement* or yield is considered to be a very serious point calling for full attention. One tenth of a per cent. more than practically necessary left in the residues such as bagasse, slices, scum or charcoal, now often gives occasion for close investigations, and steps are taken to prevent such losses as nobody thought anything of in "better days"—and so, for instance, the appearance of the "night chemist" can be accounted for! In

these times of close competition the days are past when planters could afford to disregard a per cent. more or less so long as the prices were fair, and in leading agricultural circles the percentage of saccharose in the raw material (whether cane or beet) is watched anxiously enough. There is no need of calling special attention to the anxiety manifested by the commercial body at large with regard to "a few tenths," the lawsuit of the dealers in the United States against the government, now pending, on account of "small" differences in the analyses, of raw sugars, and amounting to some odd million dollars, supplies a fine object-lesson in regard to the importance of exact polarization.

The property possessed by a sugar-solution of deflecting polarized rays will probably remain (for the near future at least) the only basis of all practical methods of analysis. However imperfect this basis may be in many cases, up to now the progress of chemistry has not discovered a more reliable or more suitable way since Prof. Eilhard Mitscherlich invented the first Polariscope, now nearly fifty years ago. Though the foundation principle of this method has remained the same ever since the analysis of saccharine juices commenced to play such an important part in the technical, agricultural, and commercial sugar-world, the instruments have, nevertheless, been considerably improved and brought to great perfection.

In former days the Ventzke-Soleil Polariscope (introduced mainly by Prof. Scheibler into the sugar industry) and the instruments of Laurent, not to mention some other less practical constructions, were almost exclusively used for polarizations. These instruments of Scheibler and Laurent are still found in some places and have their drawbacks—the former, that of not being sufficiently sensitive, particularly for dark coloured solutions and for people who suffer from colour-blindness; the latter (originally constructed for scientific purposes) that of not being useable with ordinary rays, but only with special lamps burning sodium salts.

These old constructions had to give way to the instruments made on the "half shadow principle" of Jellet-Corner, and working entirely with the rays of an ordinary lamp. The modern polariscope of this kind works with Single Quartz-Wedge Compensation, and gives very exact readings even for persons with a defective sense of colour who are met with more frequently than is desirable), and for coloured solutions. However the division of the scale from 0° to 100° of this instrument has to be checked by standard solutions or by normal Quartz-Plates.

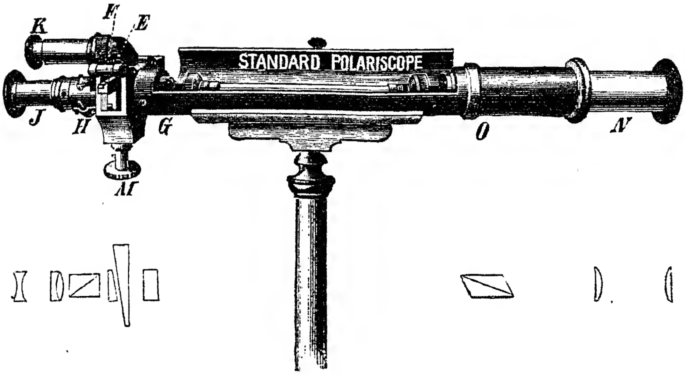

Fig. 1.—The analysing Quartz-Wedge (System F.E.G.) is here of full length and is moved by the screw M. O.—The half-shadow prism. N.—System of lighting. H.—The analysing Nicol. K.—The reading glass. J.—The observation glass.

The instruments with Double Quartz-Wedge Compensation obviate this inconvenience. They have two reading scales which permit in a very easy way the accurate control of any point of the scale, without the use of other apparatus. At the same time most of these instruments permit the reading of left polarization from $\pm$ 0° to—100° which is in some cases particularly useful for analysing glucose, inverted sugar, &c. The above-mentioned polariscopes are worked—like the old colour instruments—with two fields of observation only, and are sufficient for all ordinary requirements of the factory, the field, and of trade, of course they require good vision to obtain exact results.

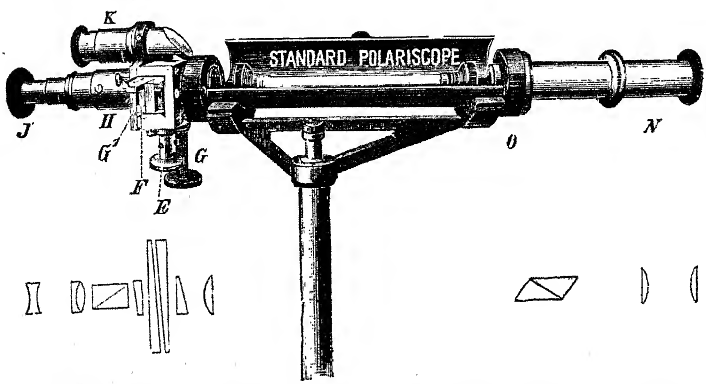

Fig. 2.—Shows the double Quartz-Wedge Compensation System at G¹ F.E.G., movable by two screws. J—The observation. K—The reading glass. H—The analysing Nicol. O—The half shadow prism. N—The light system.

The very best and newest apparatus, however, enables almost everybody to make, without difficulty, an exact reading of 0·1 %. This is the THREE DIVISION OBSERVATION INSTRUMENT, made according to Prof. Lippich's Patent. Combining, as it does, all the advantages of the half shadow instruments this is, no doubt, the most perfect polariscope in the market, and with regard to sensitiveness and precision has no equal up to now.

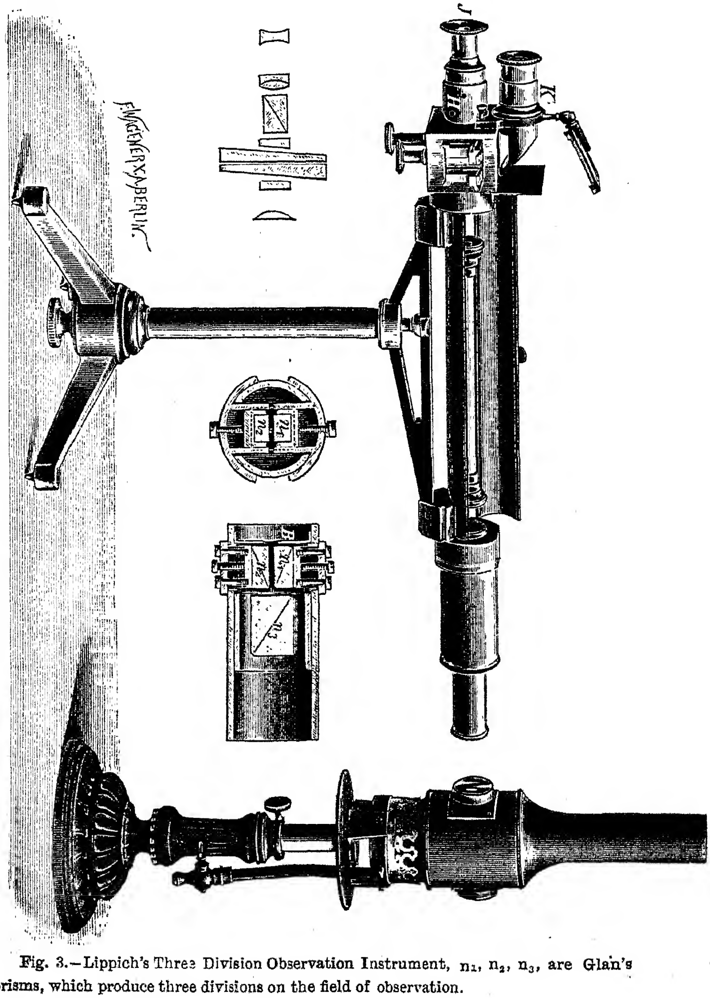

Fig. 3.—Lippich's Three Division Observation Instrument, n_1, n_2, n_3, are Glan's prisms, which produce three divisions on the field of observation.

Besides these instruments with full readings of from 0° to 100°, there are in use some constructed for special purposes, as for instance, the POLARISCOPE WITH LIMITED READINGS OF FROM 0° to 35°,

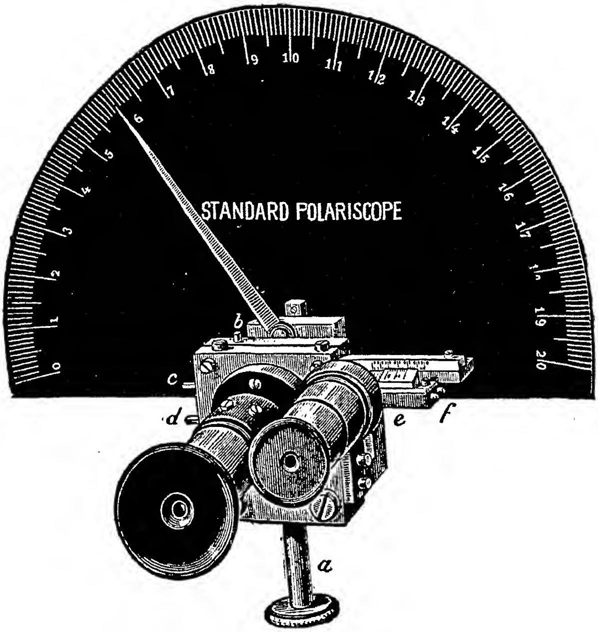

Fig. 4.—Polariscope for analysing canes, beets, &c.

which is very handy for analysing beets, slices, and canes, (particularly on Seed Farms, where sometimes over 1,000 polarizations are made per day). The advantages which instruments of this kind possess are, among others, that the Quartz-Wedges are very short and consequently can be made to perfection at moderate prices. Without going into theoretical details (*) it may be mentioned, however, that a good polariscope must have absolutely faultless quartz wedges, as only $\frac{1}{10}$ of a millimetre difference in the thickness of a quartz plate is equivalent to a difference of $6\frac{1}{4}\%$ sugar. This shows clearly that all plates, glass covers, nicols and crystals, have to be perfectly constructed, as the polarizing ray has to travel through about a dozen planes, and the slightest fault in any one surface renders the analysis illusory. For sugar analysis exclusively, the POLARISCOPE FOR CONCEN-

* The Theory and Construction of the Polariscopes is dealt with in the classic work of Prof. Dr. Landolt: "*Das optische Drehungsvermogen*," Second Edition, 1898. See *Sugar Cane*, 1898, p. 331.

TRATED SOLUTIONS OF 80° to 100° is highly to be recommended if many analyses have to be effected, as for instance, in a refinery or in a commercial laboratory. It possesses the same practical advantages as the above mentioned polariscopes with limited reading scales.

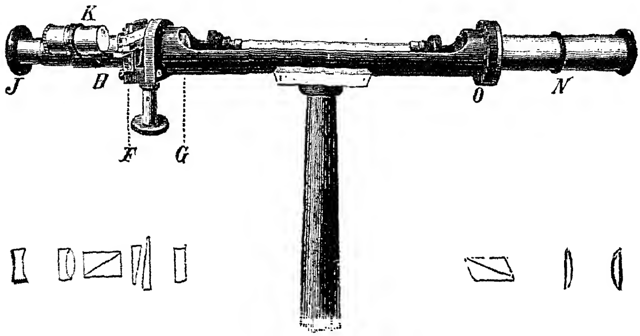

Fig. 5.—Polariscope for analysing sugars and masse cuites. The analysing Quartz-Wedge (at F.) is seen to be much shorter here than in Fig. 1.

All the above-mentioned instruments (which are made for use in temperate climates) nevertheless develope certain very disagreeable qualities as soon as the average conditions of temperature and humidity are changed. To eliminate these faults, caused by different meteorological conditions, THE STANDARD POLARISCOPE has been especially

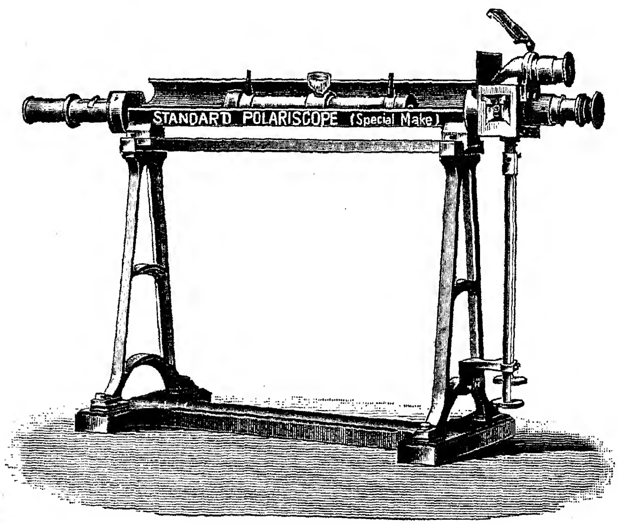

Fig. 6.—Standard Polariscope.

constructed, which is guaranteed to be—practically speaking—more correct under any change of temperature than any other instrument, and is available in all climates, tropical or temperate. Prof. Dr. H. W. Wiley, the well-known chief chemist of the Department of Agriculture of the United States of America, was the first who pointed out that polariscopes are not correct under all circumstances. In his lecture "On the Influence of Temperature on the Rotation of Sugar Solutions in Quartz-Wedge Compensating Polariscopes" delivered in Vienna at the "International Congress for Applied Chemistry, 1898," he pointed out that the influence of the temperature in hot climates is too great to be neglected. At the meeting of the foreign section of the "Union of Sugar Technologists," Professor Wiley again specified his observations. American chemists use chiefly Berlin Polariscopes adjusted at 17·5°C. The mean temperature, however, of the United States laboratories is on an average about 6° to 8° higher, for the tropics this difference would sometimes attain from 8° to 25° C. and more, and if in the United States government offices Professor Wiley already finds 0·3% lower polarisation for sugars, for most cane sugar producing countries this figure will certainly be far higher. Professor Wiley said:*

"Great danger is also to be feared from pressure on the quartz-" wedges from variations in temperature. The wedges are usually" mounted in brass, and since the expansion of brass is different from" that of quartz, a pressure may be produced which will materially" change the rotating power of the compensating wedge. It is highly" important that the wedges be mounted in such a way that a change" of temperature will produce no change in rotating power due to" pressure or strain. Again, the specific rotating power of a quartz-" wedge increases with a rise of temperature. Hence it happens that at" 25° C. a less thickness of the wedge is required to restore the rotation" produced by a sugar solution than at 17·5° C. The apparent" strength of the sugar solution is therefore diminished. Further, my" investigations have shown that the specific rotation of a sugar" solution decreases with a rising temperature; and the amount of" this change has been determined."

Professor Wiley found that with ordinary Mohr flasks, combining all factors in one expression :—

1° C. = —0·029° polarization, is to say, a solution which polarizes 100° at 17·5° C., will indicate only about 99·7% at 25° C. Further inconveniences have been pointed out by another chemist of high standing and acquainted with tropical climates, Dr. H. Winter, of

* *Centralblatt*, 1898, p. 976.

Soerabaya (Java). In tropical and particularly moist climates with great variations in temperature, it was found that the "Nicols," &c., of the instruments got "cloudy," and consequently the readings were indistinct and incorrect. The newest apparatus often became useless after a short time, and had to be sent home for repair. For this reason, the Standard Polariscope has its "Nicols," &c., protected by glass plates. Besides this, all the other parts exposed to the air are made in such a way that they are unaffected by climatic influences. Moreover the "Standard" is supplied with nickel scales which are not influenced by heat and humidity in the same manner as the old ebony scales, and do not become destroyed or useless by warping. To control the division of the scales it is, however, always desirable (for places where absolute exactitude is necessary), to have a CONTROL OBSERVATION TUBE on the spot. These tubes are very useful,

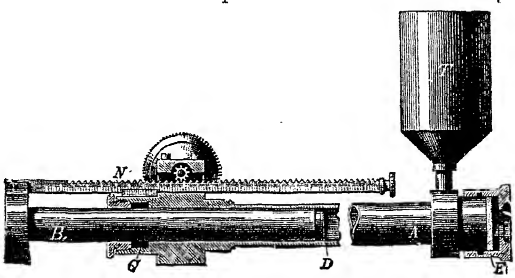

Fig. 7.—Control Observation Tube made according to the telescope system, to control scales.

save a great deal of trouble, and enable the chemist to have the polariscope—so indispensable for sugar chemistry—always under control without wasting much time. With the help of this invaluable—but far too little known—little instrument, a constant watch can easily be exercised over the whole length of the scale and a security be obtained which is otherwise only possible by the constant use of many normal saccharose solutions. In case of almost all old polariscopes (supposing they are otherwise in good condition and the *quartz-wedges not damaged*), it would be advisable to have them converted, according to special instructions, into Standards, as this can be effected with sufficient accuracy at a small cost. The price of the new Standard Polariscope is only £20 f.o.b., and it can be obtained through the agency of the writer.

GEORGE STADE.

Memb. Assoc. G. Engineers, Berlin,
Fellow of Germ. Chemical Society,
c/o. H. Busse, 21, Planufer, Berlin.

BOUNTIES ON SUGAR.

A general meeting of the Anti-Bounty League was held at the Cannon Street Hotel on the 9th January, when the course which it is proposed to follow during the coming Parliamentary session was discussed. The Rt. Hon. Lord Stanmore presided, and the Secretary, Mr. Mayson M. Beeton, read the report for 1898, from which we extract the following noteworthy paragraphs:—

Whether owing to divided counsels in the Cabinet or to the urgent pressure of business arising from the rapid succession of crises in foreign affairs which had characterised the past twelve months the "remedy" which the Government in January, 1898, "considered it their duty to find for this crying injustice"* remained in January, 1899, still to be applied. The new tariff in the United States had, indeed, by opening the American markets to non-bounty-fed sugars, giving a temporary respite to our West Indian colonies, but only at the cost of the sugar producers of India, Mauritius, and Queensland, to whose markets had been deflected the surplus bounty-fed exports of Germany, Austria, and Russia. The temporary nature of that respite had been certified by the control since undertaken by the United States over Hawaii, Cuba, Porto Rico, and the Philippines. The gradual extinction of the British refining industries of London, Liverpool, and the Clyde continued to be marked by the gradually increasing proportion of imports of foreign refined as compared with those of raw sugar. To the British farmer was still denied—in spite of the marvellous success which had attended the sugar beet experiments of 1898 throughout the United Kingdom—the chance even of testing the possibility of establishing a sugar industry in Great Britain—an industry which would confer inestimable benefit on the agricultural interests of the United Kingdom.

Sir Neville Lubbock moved:—"That the Anti-Bounty League hereby records on behalf of those interested in the sugar industry in all parts of the British Empire its disappointment and regret at the failure of the Brussels Conference to secure by international treaty the suppression of the foreign state bounty system," and in the course of his remarks stated:—

That of the sugar produced now two-thirds was beetroot and one-third cane, while before bounties were granted the production was nine-tenths cane and one-tenth beet. The beet was produced in protective countries, to which no British-made machinery went, and the loss to the British engineers by the continuance of these bounties was enormous. The loss also by the gradual destruction of the British refining industry was not less than a million and a quarter per annum. The cotton industry was suffering to the extent of half a million per annum, and so with other industries. A profit and loss account on these lines would show that this country was not gaining but losing by the sugar bounties. They were all agreed that bounties were unnecessary, and must be abolished. Speaking of the Brussels Conference, he said that if the Government had shown a little firmness there the question would have ended.

Mr. A. Eades, secretary to the Birmingham Trades Council, moved a further resolution expressing the opinion that the failure of the Brussels Conference was due to the attitude of reserve enjoined by the Government on the British delegates in their letter of instruction,

*The words in inverted commas are quoted from Mr. Chamberlain's speech on the Report of the Royal Commission.

and that such instructions were inconsistent with the previous declarations of her Majesty's Ministers on this subject.

On the motion of Sir M. M. Bhownaggree, M.P., seconded by Lieutenant-General Laurie, a resolution was passed to the effect that the Governments which had expressed their desire to abolish their system of bounties should be asked to enter into a convention with her Majesty's Government for the abolition of bounties, and that her Majesty's Government would guarantee to those foreign Powers and British producers a like security in the open markets of the British Empire against the State-aided competition of such other bounty-giving countries as might refuse to become parties to the convention, pending the adhesion of such countries to the International Convention.

Mr. C. J. Crosfield, of Liverpool, in moving a vote of thanks to the Chairman, said that :—

He did not think the active workers in the anti-bounties movement could be fairly charged with not knowing their own minds, as one speaker had indicated was the case. They had kept clearly in view the abolition of the bounties by the only practical means that existed. The logical remedy was a countervailing duty, but they were told that there were Customs difficulties that frightened her Majesty's Government. and that prohibition would be very much more simple. To his mind it did not make any difference whether they put on a duty which would shut out the products of France, or said that the production of France should not be imported. Mr. Eades had said that it would cost the workingmen of the country only a farthing a pound if they prohibited bounty-fed sugar, and that it would have very little effect on the financial arrangements of the working classes. Some of them would go so far as to say that the prohibition of bounty-fed sugar would have no effect on the working classes. Mr. Chamberlain estimated the loss at 20s. a ton, and a shilling a cwt. was not one farthing a pound, but only one-ninth of a penny a pound, which on Mr. Eades' calculation that 4lbs. a week would be a good average for the family of a workingman, showed that the loss would be a halfpenny and not a penny.

In connection with the above the following will be of interest as showing the separate action taken by the Refiners :—

Letter from the British Sugar Refiners' Committee to Lord Salisbury.

My Lord,

As Mr. Chamberlain's speech of August 2nd, on the vote for the West Indies, makes a very important new departure in the history of the Sugar Bounty question, we desire to state to your Lordship the position of the sugar refiners in this matter and their views as to the present situation.

International negotiations for the general abolition of bounties were entered into by Her Majesty's Government about the year 1862. and were continued until the year 1877, solely in order to obtain

free competition for the sugar refiners. The West Indian sugar industry at that time took an interest in these negotiations because they realised that anything which tended to reduce the volume of sugar refining in this country was likely to injure their interests also. But during those fifteen years of continuous negotiation the subject was confined to the sugar refining industry.

We therefore respectfully submit that the sugar refiners have a strong prescriptive right to consideration at the present time in the policy to be pursued for a successful termination of the negotiations.

During the latter part of this period, 1862-77, the West Indians began to realise that they were not only threatened with a loss of market in this country owing to the competition of bounty-fed refined sugar, but also that bounty-fed raw sugar was likely to become a formidable competitor. They, therefore, joined us in our endeavours to obtain the abolition of all bounties, and we have worked together most cordially ever since.

A Select Committee of the House of Commons was appointed in 1879, before which the sugar refiners and West Indians gave complete evidence both as to the history of the question and its industrial and economical aspects. The Committee in their report say that "it is of the utmost importance to the consumer that the natural sources of supply should not be destroyed." . . . "Your Committee have therefore come to the conclusion that it is desirable not only in the interest of the trades concerned, but also for the general interest of whole community that the export bounties both on raw and refined sugar should be abolished."

The negotiations had resulted in 1877 in a satisfactory convention, but the contracting powers very reasonably demanded a penal clause, which should secure them against bounty-fed competition for the future. This clause Her Majesty's Government declined to agree to.

The report of the Select Committee came therefore very opportunely to remove the erroneous scruples which had hitherto prevented Her Majesty's Government from giving to the contracting powers the security they demanded.

The report dealt as follows with this essential question of a penal clause:—"A countervailing duty not exceeding the bounty on export would place no impediment in the way of imports from countries parties to the convention for the abolition of bounties, as it would not be imposed upon their produce; in the case of imports from countries outside the convention giving a bounty, the duty

"would merely collect the bounty; and in either case the country "which possessed natural advantages would still obtain the benefit of "those advantages in competition with our own manufacturers. A "bounty, on the other hand, places all countries who do not give "bounties at a disadvantage in our market and deprives them of any "natural advantages they may possess; it deprives our own pro- "ducers of the opportunity of free competition in our own markets, "and if sufficiently large, renders it practically impossible for them "to carry on their trade. A countervailing duty is not therefore in "any sense of the term protection."

Fortified with this report the sugar refiners and West Indian planters naturally expected that a speedy end would be put to the negotiations by the conclusion of a satisfactory convention. But unfortunately a change of government led to the question being shelved in the Board of Trade, a department at that time unfavourable to the abolition of bounties.

We had therefore to wait until 1887 before further steps were taken for the settlement of the question. In the meantime great changes had taken place in the sugar industry, and all our warnings of what would happen if bounties were allowed to continue had come true. The sugar refiners had asserted that foreign refined would gradually be substituted for that of British manufacture. The West Indians foresaw that continental beetroot sugar would drive their produce from our markets, and would eventually depress prices below the cost of production, These fears were verified. If the convention of 1877 had been completed and enforced, the West Indies would have been preserved from ruin and our industry would have been maintained. The convention of 1888 only came in time to save the remnants of these two branches of the British sugar industry,

On this occasion Her Majesty's Government were prepared to agree to a penal clause and the convention was on the point of being ratified, but at the first sign of a small and feeble opposition in the House of Commons the Government withdrew the project and our last hope was gone.

How matters have gone from bad to worse since then it is hardly necessary to recapitulate. The imports of foreign refined beetroot sugar, which in 1870 amounted to 81,574 tons, had risen in 1897 to 791,605 tons. The imports of raw beetroot sugar had risen in the same period from 83,756 tons 478,847 tons, and the total production of beetroot sugar had risen from 846,421 tons to 4,900,839 tons.

Owing to the lamentable state of our West Indian Colonies, resulting from this remarkable transfer to the European beet fields of more than half the visible sugar production of the world, the sugar bounty question has become, in the popular mind, very much a West Indian question, though, as we have pointed out, it is in its origin and progress still more a sugar refiner's question, and is now, as the figures just quoted most eloquently prove, more vitally important than ever to our industry.

It is perhaps fortunate for us that the sorrows of the West Indies have caused the sugar bounties to become once more a burning question, and it is now only necessary for us now to indicate, in reviewing Mr. Chamberlain's recent important speech, the points where a consideration of our interests may involve some modification of his conclusions.

The statement of his views with regard to the Penal Clause, without which no convention for the abolition of bounties can possibly be obtained, disposed completely of all scruples as to the acceptance of such a clause by Her Majesty's Department. He said:—

"If we did not threaten countervailing duties it was not because "we were influenced by any theoretical idea that such a course would "be opposed to free trade. That, for one, I absolutely and entirely "deny. I assert that a statement of that kind is made by modern "free traders who have gone astray in the true doctrines of free "trade, or who profess to be more orthodox than the authors of "free trade. I say it would be impossible to find in the writings of "any of those who advocated free trade any justification for the theory "that bounties given in the way in which these are given by foreign "Powers to the detriment of British producers may not be in some "way or other countervailed. I read in the speeches of Bright and "Cobden, and other great authorities on the subject, that the main "object of free trade is to secure the natural course of production and "exchange, that each nation is to produce what it is best fitted to "supply, and to exchange its produce with other nations without "artificial preference. This is the object at which free trade aims, "and it is violated by the bounties, *which give an artificial preference* "*to foreign products in British markets;* and a countervailing duty "would only restore free trade and secure the natural condition of "ordinary competition which it is the effect of a bounty to destroy."

These words are conclusive and final, and remove for ever all theoretical difficulty with regard to the Penal Clause. It is not

necessary to threaten, it is only necessary to agree to a clause which has always been asked for by the foreign governments as a security to them that if they abolish their bounties their sugar producers will not have to contend in our markets with bounty-fed competition from other quarters. This is so manifestly necessary for their security that it is evidently impossible to obtain an agreement to abolish bounties on any other terms.

Mr. Chamberlain believes "that if the bounty system were abolished the sugar industry would be able to continue as an ordinary industry in a normal state." He further states that, in his opinion, "20s. a ton measures the advantage to the consumer *at the present time*" (August 2nd, 1898), and that "it would have to be considered as the extent of the injury done to the consumer if the bounties were abolished." In other words, 1-9th of a penny a pound.

These would all appear to be sufficiently good arguments for the immediate acceptance of a convention, but, unfortunately, Mr. Chamberlain makes reservations. The penal clause, if it had to be enforced, would, in his opinion, involve expense and hindrance at the Custom House.

This we contend is an imaginary difficulty. The only country which at present refuses to agree to a general abolition of bounties is France. The prohibition of the importation of French sugar would present no practical difficulties, because French sugar must come from French ports, and therefore could be identified immediately. French sugar could never come from the ports of neighbouring countries, because these countries, having abolished bounties, would lend no such assistance; while on the other hand the same reason, together with physical and fiscal difficulties effectually prevent sugar from neighbouring countries being shipped from French ports.

In dealing with this objection, Mr. Chamberlain also argues that the Government should avoid, if possible, meddling with a trade of 1,500,000 tons in order to benefit a trade of only 260,000 tons. He forgets the sugar refining trade, which was formerly 840,000 tons, and which, if bounties were abolished, might easily be restored to that figure and to half as much again. It now amounts to 630,000 tons, while the importation of bounty-fed foreign refined amounts to 790,000 tons.

Further collateral reasons for delay are given by Mr. Chamberlain. Before making our negotiations successful the Government must be convinced, he says:—

1. That the case is urgent.

2. That all other means have been exhausted.

3. That the change would be of great benefit to the threatened industry.

We reply:—

1. If the urgency of the case as regards the West Indies has been reduced by the fact of a rise of 1s. a cwt. from the recent lowest point of the market, such an argument has no force with regard to the British sugar refining industry. The refiner is undersold by such a mere fraction as 3d. per cwt., whatever may be the price of sugar. This 3d. is a great deal to him, in fact his living, but it is absolutely nothing to the consumer.

2. The exhaustion of all other means, if it refers to the possible conclusion of a convention, will not relieve the Government from the necessity of agreeing to a penal clause, because it is quite certain that the foreign Governments will never accept a treaty without that necessary security.

3. It is manifest that the abolition of bounties must be not only "of great benefit to the threatened industry," but absolutely essential to its existence.

So long as our sugar industries are subject to an artificial competition which periodically drives prices below the cost of production, no prudent capitalist will invest money in the central factories so universally admitted to be necessary if our West Indian sugar industry is to survive.

At the present moment the West Indies have a good market in the United States, where the European bounties are countervailed. But, bounties so stimulate production, that they will, if they are allowed to continue, most assuredly force prices once more below the cost of production. Experts on the Continent, very competent to give an opinion, have assured us that if the Conference fails to come to an agreement, the war of bounties will become fiercer than ever.

The specially good market in the United States is, moreover, a very precarious one. It will gradually disappear as the protected industries in Louisiana, the Sandwich Islands, and the beetroot districts of the United States increase their production. It is not yet known what protection will be granted to the sugar industries of Cuba, Porto Rico, and the Philippines, but it is generally anticipated that some stimulus will be given in those countries, and that this will be another reason why the United States market will not long remain so favourably open to our West Indian produce.

In any case, this objection to immediate action, like the others, does not apply to the sugar refiners. We suffer, not periodically, but constantly, from a bounty system which is rapidly substituting foreign for British refined sugar, at a difference in price which can only be represented in our case by the ninth part, not of a penny, but of a farthing, a pound.

The declarations of Mr. Chamberlain on the soundness of a penal clause, and the inappreciable effect of the abolition of bounties on the price of sugar, are sufficient in themselves to remove all hindrance to the progress of negotiations for the speedy abolition of a system which he truly describes as giving "an artificial preference to foreign products in British markets." It puts the matter now entirely in the hands of Her Majesty's Government, who are masters of the situation and can, if they will act on Mr. Chamberlain's views, obtain a satisfactory and unanimous convention without further difficulty.

We hope we have succeeded in convincing your Lordship first, that the sugar refiners have a prescriptive claim to consideration in this matter, and, secondly, that the declaration of Mr. Chamberlain has cleared away all the former impediments to progress towards the abolition of this unique case of protection to foreign producers in British markets.

Apart from all other considerations, we may finally urge what is perhaps the strongest reason of all for action in this matter, that we have a constitutional right to free competition in our own market, and that this right is denied to us so long as Her Majesty's Government permit foreign Governments to "give an artificial preference to foreign products in British markets."

I am, my Lord,

Your obedient servant,

(Signed) Edwin Tate,

Chairman, British Sugar Refiners' Committee.

21, Mincing Lane,

December, 1898.

The *Demerara Argosy* states that there was a slight increase during 1898 in the acreage under cane cultivation, which since 1896 has remained at about 67,000 acres, and thinks a slight yearly increase may be expected in future. There are 60 estates on which sugar is manufactured; one of these is over 3000 acres, three over 2000, seven over 1500, and fourteen over 1000.

COUNTERVAILING DUTIES AND CANE SUGAR.

The following, translated from the *Deutsche Zuckerindustrie* (1898, No. 48, col. 1716 et sqq.), constitutes a further portion of the correspondence which is being exchanged between Mr., now Sir Nevile Lubbock and the Editor of that journal (see our January number, pp. 25-28). As the whole of Mr. Lubbock's letter is quoted in the course of Dr. Hager's reply, it is not necessary to give it separately:—

Differential Duty and the Price of Cane Sugar.

Mr. N. Lubbock, of London, sends us the following:—

I regret to see from your remarks (as printed in your No. 44, col. 1554 et sup.,) upon my recent communication that we are not agreed as to the effect of countervailing duties in America upon the price of cane relatively to beet sugar.

In asserting, as I did in my last communication, that the value of cane sugar, as compared with beet, had increased by about £1 per ton in consequence of the imposition of countervailing duties in America, I was giving you the result of my actual experience in selling large quantities of British West India sugar. Take, for example, the months of October in each of the three years 1895, 1896, and 1898. I purposely omit the year 1897, because in consequence of the change in the sugar legislation the condition of the market in that year was abnormal, and the quotations of that time would prove nothing.

According to C. Czarnikow's weekly circular, published in London, the average price of German beet 88% f.o.b. Hamburg was, during the months of October, respectively:—

1895.		1896.		1898.
10s. 8¾d.	....	8s. 11d.	....	9s. 7½d.

Taking now cane sugar 96° polarisation, according to Willett and Gray's circular, published weekly in New York, the average duty-paid price during the same periods was:—

	October. 1895.	October. 1896.	October. 1897.
Per 100 lbs. duty paid	\$3·56	\$3·06	\$4·23
,, ,, less duty..	\$2·55	\$2·19	\$2·545
Adding 12 lbs. (cwt.)	\$2·85	\$2·45	\$2·85
Exchange \$4·86 (in bond)	11s. 8¾d.	10s. 1d.	11s. 8¾d.
Value of beet..	10s. 8¾d.	8s. 11d.	9s. 7½d.
Difference	1s. 0d.	1s. 2d.	2s. 1¼d.

'This would mean a difference of about one shilling in favour of cane sugar, as compared with the period before the countervailing duty. But Mr. Lubbock will allow us to call his attention to the fact that a comparison between the New York cane sugar prices and the London beet sugar prices cannot throw much light on the question in dispute. The question is, at what price the Americans buy colonial sugar when they at the same time buy beet sugar, and for that reason the prices of both kinds of sugar in the New York market must be compared. In his communication reproduced in our No. 44, Mr. Lubbock quite rightly spoke solely of prices in the New York market, and thereupon we showed him that any noteworthy difference in

favour of colonial sugar, between the time before and the time after the introduction of the countervailing duty, did not exist.

The difference in price which Mr. Lubbock makes out by means of a comparison of the October quotations before and after the countervailing duties proves nothing. We can put before him figures which will show exactly opposite results. In October, 1897, *i.e.*, after the countervailing duties, the average price for 96° sugar in New York was \$ 3·64 per 100 lbs., equal to \$1·95 in bond, or M. 9 per ctr., whereas the average price for 88% sugar in Hamburg was M 8·60. Here, therefore, the difference, which, according to Mr. Lubbock, was about M. 1 before the introduction of the countervailing duty, *after* the introduction of that duty instead of increasing to about M. 2, as Mr. Lubbock believes, had fallen to 40 pfg.

As already stated, in order to determine the question proposed by Mr. Lubbock we must consider, not so much the quotations in New York, but rather the prices which, on the one hand, the colonial producers, and on the other the beet sugar producers, in the sugar-producing countries themselves, obtain when they part with their sugars. For the point of the question is whether the producer of cane sugar, as compared with the producer of bounty-fed sugar, obtains an advantage in price in consequence of the countervailing duty.

Mr. Lubbock will admit that Java, for instance, in consequence of its much greater production, comes much more into the question than the British West Indies when it is required to determine whether the cane sugar industry, as compared with the beet sugar industry, has gained an advantage or not. Let us compare the quotations for Java sugar (muscovado) in Soerabaia, published regularly in the "Archief for the Java Sugar Industry," with the prices of 88% f.o.b. Hamburg in monthly averages, taking several months before and several months after the coming into force of the American countervailing duties. We then find :—

Before the Countervailing Duty.

	M. Pf.
April, 1895.—Soerabaia, fl.6·29 per picul = ...	8·70
,, ,, Hamburg	9·20
Difference	0·50
May, 1895.—Soerabaia, fl.6·92 per picul = ...	9·55
,, ,, Hamburg	10·10
Difference	0·55

April, 1897.—Soerabaia, fl.5·69 per picul =	.. ..	7·86
,, ,, Hamburg	.. ..	8·79
Difference	.. ..	0·93
May, 1897.—Soerabaia, fl.5·87 per picul =	.. ....	8·10
,, ,, Hamburg	.. ..	8·83
Difference	.. ..	0·73

After the Countervailing Duty.

Oct., 1897.—Soerabaia, fl.5·87 per picul =	.. ..	8·10
,, ,, Hamburg	.. ..	8·60
Difference	.. ..	0·50
May, 1898.—Soerabaia, fl.6·75 per picul =	.. ....	9·31
,, ,, Hamburg	.. ..	9·61
Difference	.. ..	0·30
Aug., 1898.—Soerabaia, fl.6·50 per picul =	.. ..	8·98
,, ,, Hamburg	.. ..	9·50
Difference	.. ..	0·52
Sep., 1898.—Soerabaia, fl.6·57 per picul =	.. ....	9·07
,, ,, Hamburg	.. ..	9·67
Difference	.. ..	0·60
Oct., 1898.—Soerabaia, fl.6·50 per picul =	.. ..	8·98
,, ,, Hamburg	.. ..	9·90
Difference	.. ..	0·92

Before the countervailing duty the average difference stood at M.0·67 in favour of the German sugar; after the countervailing duty at M.0·57. We cannot, therefore, conclude that, as far as the comparison between prices of Java and German sugar is concerned, this duty has brought about any change. It must then not be said that cane sugar is worth more by the amount of the beet sugar bounties.

Mr. Lubbock continues :—

I am sorry also to see that you have misunderstood my letter with regard to one point. You accuse me of saying that the German sugar producer receives less for his sugar when he sells to America than when he sells to England. That is a misunder-

standing, for I stated clearly in my letter that he obtains the same price whether he sells in New York or in London. What I do state is that, relatively to cane, when the German producer sells in New York, he is getting less than he was getting before the imposition of countervailing duties, or, as I then worded it, that cane sugar, relatively to beet, is obtaining £1 per ton more in New York now than previously to the imposition of countervailing duties, and I cannot follow your argument that if this is so, the Germans *must*, as you say, "obtain less for this sugar when sold in New York than in England." These are questions of fact, and it is nnquestionably the fact that cane sugar is realising in New York, *quâ* beet, £1 per ton more than it did before the imposition of countervailing duties, and it is undoubtedly the fact that the German seller of beet obtains the same price whether he sells in London or in New York.

This is already refuted above.

Further, Mr. Lubbock answers our question as to why he is still agitating for the removal of the bounties, notwithstanding that he is already enjoying, according to his opinion, an advantage in the price for his colonial sugar in consequence of the courtervailing duty, *i.e.*, when he believes he already possesses the very advantage which he is hoping to obtain from the removal of the bounty, and this is his reply:—

May I now explain to you why, although this is my view, I am still in favour of the abolition of the bounties? It is true that at the present moment, and so long as the United States market is open to us with a countervailing duty for beet, we are not suffering from the bounties in regard to price. But we object to bounties for the following reasons:—

1. That we have no certainty that the countervailing duties will be continued.
2. That the bounties will not be increased.
3. That before long the United States may not produce sufficient sugar for the whole of their requirements.
4. Because, while all these uncertainties continue, capitalists will not invest their capital in the sugar industry in the West Indies;
5. and lastly. Because as British colonists we believe our sugar ought to be admitted free upon British markets, under the conditions of the most favoured nation, which is not the case while bounties are permitted to operate.

The answer to our second and much more important question Mr. Lubbock has not yet given. That question is: How does it come about that even now, after the introduction of countervailing duties, large quantities of cane sugar are still sent to England, although the cane sugar producer obtains in the American market a higher price for his wares than in England? During the period October, 1897, up to October, 1898 (the countervailing duties came into force July 24th, 1897), 286,081 tons of colonial sugar have gone to England, and it is quite impossible for any thinking business man to believe that a single centner of cane sugar would be sold to England when the American market would offer one mark more for it. Moreover, since the coming into force of the countervailing duty and up to the end of

October, 1898, no less than 1,032,521 English cwt. (equal to 524,521 double centner) or 51,626 tons of British West India sugar have been imported into England. Is not this a valuable illustration of the assertion of Mr. Lubbock that his West Indian sugar obtains a better price when it seeks the American market than when it goes to the English market?

In conclusion Mr. Lubbock says:—

I entirely agree with your remark that the German producer does actually receive the bounty, whether he sells to America or to England, but it is equally true, in my opinion, that when he sells his sugar in the United Kingdom or in the United States he obtains at the present moment £1 5s. per ton less than he would if there were no bounties at all, and hence, though he receives a bounty, he receives no benefit from it, as he is forced by competition to give it all away to those who buy his sugar.

Once more, then, the *ceterum censeo:* "Remove the bounties and you will be in a better position." And yet the sole object of Mr. Lubbock's agitation is that the colonial sugar industry should be better off! How can these be made to agree? We could easily overcome Mr. Lubbock by quoting the oft-repeated opinion of the British sugar refiners, to the effect that the German sugar producers retain their bounties and not merely obtain them. But we will just ask him whether the following reasoning is not correct. If we remove the bounties the differential tax in America will disappear and with it the advantage in price for cane sugar. Beet and cane will then stand on the same footing whether the price of sugar, after the removal of the bounties, rises, falls, or remains the same. The difference between the two can then only exist in the natural conditions of production, which for the colonial product, however, are much more favourable than for the beet product, since up to six tons more sugar per hectare can be obtained in the colonies than with us. Therefore, because there would then be created for the cane a crushing preponderance over beet, for that reason—and that reason only—Mr. Lubbock wants to attack the bounties, but for that very reason we shall maintain them.

It is interesting to note that a British firm of Engineers, Babcock and Wilcox, Ltd., Glasgow, London, etc., have received from an American Electric Company the large order for 60 stationary boilers of about 1000 h.p. each.

SUGAR BEET GROWING IN ENGLAND, SCOTLAND, AND IRELAND, 1898.

By SIGMUND STEIN, Manager for Crosfield, Barrow & Co., Sugar Refiners, in Li erpool.

(Continued from page 39.)

III.—IRELAND.

Reference Number.	Trial made by	Farming at	Kind of Soil.	Manure used, and Quantity per Acre.
37	Mr. Edward Walsh........	Poolrone, Mooncoin, Co. Kilkenny	Rich	5 tons farmyard manure, super-phosphate.
68	Mr. Aidan Ennis..........	Springwood, Ballymilly	Red, shingly subsoil ..	50 tons farmyard manure, 4 cwt. super-phosphate.
77	Mr. James Ormond	Clogheen, Ballymacraberry, Co. Waterford.	Loam	40 tons of cow manure.
78	Mr. Edmond Gorman	Littleton, Thurles, Co. Tipperary	Heavy stiff clay	Ordinary manure.
92	Mr. Edward O. Seal	Tincurry, Ballycarney, Co. Wexford ..	Clay loam	50 tons of farmyard manure, 3 cwt. super-phosphate
85	Mr. F. Fitzpatrick	Pullyquelly House, Rathfriland, Newry	Sandy loam	Special bone compound.
101	The Fergus Reclamation Syndicate	Tiermaclane, Ennis, Co. Clare	Alluvial deposit	No manure.
102	Mr. P. MacManus	Tempo, Co. Fermanagh	Peaty soil	25 tons farmyard manure, 2 cwt. super-phosphate.
105	Mrs. Kavanagh	Altclonghfin, Garvaghey, Ballycowley, Co. Tyrone.	....	....
126	Mr. Garrett Begg	Beggsboro', Cabra, Dublin	Clay	30 tons farmyard manure.
147	Mr. A. A. Lane...........	Bordewood, Kells, Meath..............	Light loam	5 cwt. super-phosphate.
140	Mr. J. Golden	Enniskerry, Co. Wicklow..............	Light sandy, gravelly subsoil.	3 cwt. nitrate of soda.

Reference Number.	Duration of Growth. Days.	Previous Crop.	Schreiber "Elite," (German Seed). Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of the Roots.	Vilmorin (French Seed), "Blanche." Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of the Roots.	Compared with F. O. Licht, Magdeburg. Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.
37	153	Oats	1226	15·00	2·20	87·21	14·20	942	13·80	2·60	84·14	13·00	491	16·12	2·78	85·29
68	146	Oats	923	14·10	2·10	87·04	13·60	742	12·80	2·40	84·21	14·70	537	16·44	2·86	85·18
77	150	Cabbage	572	15·20	2·10	87·86	14·70	....	....	....	....	....	537	16·44	2·86	85·18
78	156	Barley	854	16·50	2·60	86·38	16·00	....	....	....	....	....	537	16·44	2·86	85·18
92	162	Spring oats....	861	13·90	2·40	8[illegible]·27	13·40	845	13·70	2·60	84·05	13·20	580	16·75	3·15	84·17
85	124	Oats	826	13·70	2·70	83·52	13·00	....	....	....	....	....	580	16·75	3·15	84·17
101	162	Oats	....	....	....	....	....	1021	15·00	2·40	86·21	14·40	580	16·75	3·15	84·17
102	153	Leeks	942	15·40	2·40	86·51	14·60	1115	13·90	2·30	85·80	13·40	580	16·75	3·15	84·17
105	....	......	495	16·00	2·20	87·91	15·50	301	17·40	2·30	88·33	16·70	580	16·75	3·15	84·17
126	162	Cabbage	1995	16·00	2·30	87·43	15·20	1937	14·20	2·30	86·06	13·70	580	16·75	3·15	84·17
147	177	Fallow	572	17·40	2·70	86·56	16·10	....	....	....	....	....	580	16·75	3·15	84·17
140	177	Potatoes and turnips	633	18·90	3·30	85·13	18·00	612	18·30	2·60	87·56	17·50	580	16·75	3·15	84·17

III.—IRELAND—*Continued.*

Reference Number.	Trial made by	Farming at	Kind of Soil.	Manure used, and Quantity per Acre.
59	Mr. Samuel Garty	Brutonstown, Killucan, Co. Westmeath	Clayey	15 tons farmyard manure.
68	Mr. Aidan Ennis	Springwood, Ballymilly	Red, shingly subsoil ..	50 tons farmyard manure, 4 cwt. super-phosphate.
90	Mr. Alexander Rudd	Munfin, Ballycarney, Co. Wexford	Light, yellow soil, clay subsoil.	40 tons farmyard manure and compost, 6 cwt. artificial manure.
92	Mr. Edward C. Seal	Tincurry, Ballycarney, Co. Wexford ..	Clay loam	50 tons of farmyard manure, 3 cwt. super-phosphate.
101	The Fergus Reclamation Syndicate	Tiermaclane, Ennis, Co. Clare	Alluvial deposit	No manure.
140	Mr. J. Golden	Enniskerry, Co. Wicklow.............	Light, sandy, gravelly subsoil.	3 cwt. nitrate of soda.
135	Mr. D. Douglas...........	Bushmills, Co. Antrim	Clayey loam	40 tons farmyard manure, 10 cwt. dissolved bones.

Reference Number.	Duration of Growth.	Previous Crop.	Janasz (Russian Seed), "Zuckerreiche."					Mette "Wanzleben" (German Seed).					Compared with F. O. Licht, Magdeburg.			
	Days.		Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of the Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of the Roots.	Average Weight in Grammes.	Quantity of Sugar In 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.
59	143	Lea oats	759	14·50	2·70	84·30	14·00	....	....	....	....	....	537	16·44	2·86	85·18
68	146	Oats	....	....	....	....	.....	774	15·30	2·30	86·85	14·40	537	16·44	2·86	85·18
90	141	Winter oats ..	1144	13·40	2·80	82·71	12·90	....	....	....	....	....	580	16·75	3·15	84·17
92	162	Spring oats ..	....	....	....	....	....	1428	13·30	2·40	84·71	12·60	580	16·75	3·15	84·17
101	162	Oats	....	....	....	....	....	922	13·90	2·20	86·33	13·20	580	16·75	3·15	84·17
140	177	Potatoes and turnips	....	....	....	....	....	400	19·00	2·70	87·55	18·10	580	16·75	3·15	84·17
135	179	Corn	....	....	....	....	....	713	17·70	2·90	85·92	17·00	5·80	16·75	3·15	84·17

III.—IRELAND—*Continued.*

Reference Number.	Trial made by	Farming at	Kind of Soil.	Manure used, and Quantity per Acre.
88	Mr. John Martin	Ballylane, Markethill, Co. Armagh	Rich loam	Farmyard manure.
101	The Fergus Reclamation Syndicate	Tiermaclane, Ennis, Co. Clare	Alluvial deposit	No manure.
105	Mrs. Kavanagh...........	Altclonghfin, Garvaghey, Ballygawley, Co. Tyrone.	....	....
126	Mr. Garrett Begg..........	Beggsboro' Cabra, Dublin..............	Clay	30 tons farmyard manure.
135	Mr. D. Douglas	Bushmills, Co. Antrim	Clayey loam	40 tons farmyard manure, 10 cwt. dissolved bones.
103	Mr. William Bourke	Glidaion, Dungarvan, Waterford	Light clay	Lime.
140	Mr. J. Golden	Enniskerry, Co. Wicklow..............	Light, sandy, gravelly subsoil	3 cwt. nitrate of soda.
136	Mr. R. Mc.Dermont	Templehouse Estate, Bunnanadden, Co. Sligo.	Calcareous, yellow clay subsoil	No manure.
135	Mr. D. Douglas	Bushmills, Co. Antrim	Clayey loam	40 tons farmyard manure, 10 cwt. dissolved bones.
132	Mr. J. R. Markey..........	Julianstown, Rockbellen, Co. Meath ..	Deep clay	30 tons farmyard manure.

Reference Number.	Duration of Growth. Days.	Previous Crop.	BREUSTEDT (German Seed), "Elite." Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of the Roots.	METTE "Vilmorin," (German Seed). Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of the Roots.	Compared with F. O. LICHT, Magdeburg. Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar to 100 parts of the Juice.	Purity.
88	151	Flax	725	13·10	2·70	82·91	12·60	....	....	....	....	....	580	16·75	3·15	84·17
101	162	Oats	....	....	....	....	....	1418	13·30	2·60	83·64	12·60	580	16·75	3·15	84·17
105	....	......	....	....	....	....	....	519	17·90	2·50	87·74	17·00	580	16·75	3·15	84·17
126	162	Cabbage	....	....	....	....	....	2265	14·40	2·50	85·21	13·70	580	16·75	3·15	84·17
135	179	Corn..........	....	....	....	....	....	943	16·40	2·70	85·86	15·70	580	16·75	3·15	84·17

Reference Number.	Duration of Growth. Days.	Previous Crop.	KLEIN (Russian Seed), "Vilmorin." Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of the Roots.	SCHREIBER "Wanzleben," (German Seed). Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of the Roots.	VILMORIN (French Seed), "Blanche." Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of the Roots.	Compared with F. O. LICHT, Magdeburg. Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice	Purity.
103	151	Oats	742	14·70	2·20	86·98	14·20	....	....	....	....	....	....	....	....	....	....	580	16·75	3·15	84·17
140	177	Potatoes and turnips.	....	....	....	....	....	531	16·70	2·90	85·20	16·00	....	....	....	....	....	580	16·75	3·15	84·17
136	153	Cabbage	....	....	....	....	....	1390	15·10	2·80	84·36	14·50	923	17·60	2·70	86·69	17·10	580	16·75	3·15	84·17
135	179	Corn..........	....	....	....	....	....	833	16·70	2·40	86·91	16·10	801	18·20	3·10	85·44	17·10	580	16·75	3.15	84·17
132	193	Turnips	....	....	....	....	....	1792	16·20	2·40	87·09	15·70	937	15·50	2·40	86·58	15·00	580	16·75	3·15	84·17

III.—IRELAND—*Continued.*

Reference Number.	Trial made by	Farming at	Kind of Soil.	Manure used, and Quantity per Acre.
180	Mr. A. Alderton	Bessbrook, Co. Armagh	Light sandy	15 loads farmyard manure, 1 cwt. nitrate of soda, 2 cwt. superphosphate.
169	Mr. W. Livingstone	Annesborough House, Lurgan, Co. Armagh.	Light loam, clay subsoil.	30 tons farmyard manure.
170	Mr. Tom Clarke	Lurgan, Co. Armagh..................	Heavy loam, clay subsoil.	30 tons farmyard manure.
177	Sir John Arnott, Bart.	Lavagh Farm, Bandon, Co. Cork	Light soil on brown stone.	6 cwt. fish manure, 4 cwt. nitrate of soda.
191	Professor T. P. Carroll	Government Model Farm, Glasnevin, Dublin.	Clay loam, clay subsoil	20 tons farmyard manure, 2 cwt. kainite, 2 cwt. superphosphate, 1 cwt. nitrate of soda, 1 cwt. sulphate of ammonia.
192	Do. do.	Do. do. do.	Do. do. ..	20 tons farmyard manure, 2 cwt. kainite, 2 cwt. superphosphate, 1 cwt. nitrate of soda.
194	Do. do.	Do. do. do.	Do. do. ..	20 tons farmyard manure.
195	Do. do.	Do. do. do.	Do. do. ..	A mixture of 1 part sulphate of ammonia, 2 parts kainite, 2 parts mineral phosphate, at the rate of 6 cwt. per acre.
196	Do. do.	Do. do. do.	Do. do. ..	$2\frac{1}{2}$ cwt. sulphate of ammonia.
197	Do. do.	Do. do. do.	Do. do. ..	$2\frac{1}{2}$ cwt. nitrate of soda.

Reference Number.	Duration of Growth.	Previous Crop.	Simon Legrand (French Seed), "Blanche."															Compared with F. O. Licht, Magdeburg.			
	Days.		Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of the Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of the Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice	Purity.	Quantity of Sugar in 100 parts of the Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.
180	204	Vetches	1472	19·30	3·10	86·16	18·00	....	....	....	....	....	....	....	....	....	....	580	16·75	3·15	84·17
			Vilmorin (French Seed), "Blanche."					Schlieckmann (German Seed).					Mette (German Seed), "Vilmorin."					Compared with F. O. Licht, Magdeburg.			
169	168	Potatoes	950	14·10	2·30	85·97	13·60	1038	16·80	2·60	86·55	16·10	....	.. .	....	....	....	580	16·75	3·15	84·17
170	168	Cabbage	733	18·80	2·10	89·95	18·10	836	18·80	2·90	86·63	18·20	....	....	....	....	....	580	16·75	3·15	84·17
177	174	Pasture	....	....	....	....	....	....	....	....	....	....	1833	18·40	2·70	87·20	17·60	580	16·75	3·15	84·17
			Schreiber (German Seed), "Zuckerreiche."					Mette (German Seed), "Vilmorin."					Vilmorin (French Seed), "Blanche."					Compared with F. O. Licht, Magdeburg.			
191	187	Fallows	613	17·90	2·40	88·17	16·90	631	18·60	2·60	87·73	18·00	581	14·10	2·20	86·50	13·40	580	16·75	3·15	84·17
192	187	Do.	492	16·70	2·70	86·08	15·90	784	15·60	2·80	84·78	14·90	576	13·80	2·70	81·65	13·00	580	16·75	3·15	84·17
194	187	Do.	752	15·80	2·90	84·48	14·90	542	16·80	2·60	86·54	15·90	441	17·20	2·50	87·30	16·10	580	16·75	3·15	84·17
195	187	Do.	816	16·60	3·10	84·26	16·00	519	12·40	2·40	83·78	11·70	819	19·00	2·60	87·96	18·10	580	16·75	3·15	84·17
196	187	Do.	419	19·50	2·20	89·86	18·70	622	15·50	2·90	84·24	14·30	572	20·00	2·60	88·49	18·30	580	16·75	3·15	84·17
197	187	Do.	555	20·00	2·40	89·29	18·10	713	15·30	2·20	87·43	14·60	641	16·70	2·70	86·08	16·00	580	16·75	3·15	84·17

III.—IRELAND—*Continued*.

Reference Number.	Trial made by	Farming at	Kind of Soil.	Manure used, and Quantity per Acre.
198	Professor T. P. Carroll....	Government Model Farm, Glasnevin, Dublin.	Clay loam, clay subsoil	20 tons farmyard manure, 2 cwt. kainite, 2 cwt. superphosphate, 1 cwt. nitrate of soda, 1 cwt. sulphate of ammonia.
199	Do. do.	Do. do. do.	Do. do. ..	20 tons farmyard manure, 2 cwt. kainite, 2 cwt. superphosphate, 1 cwt. nitrate of soda.
200	Do. do.	Do. do. do.	Do. do. ..	20 tons farmyard manure.
201	Do. do.	Do. do. do.	Do. do. ..	A mixture of 1 part sulphate of ammonia, 2 parts kainite, 2 parts mineral phosphate, at the rate of 6 cwt. per acre.
202	Do. do.	Do. do. do.	Do. do. ..	$2\frac{1}{2}$ cwt. sulphate of ammonia.
203	Do. do.	Do. do. do.	Do. do. ..	$2\frac{1}{2}$ cwt. nitrate of soda.

Reference Number.	Duration of Growth.	Previous Crop.	Mette (German Seed), "Wanzleben."										Compared with F. O. Licht (Magdeburg).			
	Days.		Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of the Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.	Quantity of Sugar in 100 parts of the Roots.	Average Weight in Grammes.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Purity.
198	187	Fallows	665	20·20	2·90	87·45	18·10	....	....	....	....	....	580	16·75	3·15	84·17
199	187	Do.	671	18·00	2·60	87·38	17·10	....	....	....	....	....	580	16·75	3·15	84·17
200	187	Do.	918	17·10	3·10	84·65	16·00	....	....	....	....	....	580	16·75	3·15	84·17
201	187	Do.	844	14·30	2·80	83·62	13·60	....	....	....	....	....	580	16·75	3·15	84·17
202	187	Do.	723	16·70	2·90	85·20	15·90	....	....	....	....	....	580	16·75	3·15	84·17
203	187	Do.	681	15·80	2·60	85·86	15·00	....	....	....	....	....	580	16·75	3·15	84·17

VISCOSITY OF SYRUPS, FORMATION OF MOLASSES, &c.

(Translated from the *Chemiker-Zeitung.*)

Referring to a debate which took place at the Third International Congress for Applied Chemistry (Vienna, 1898), Dr. von Lippman, writing to the *Deutsche Zuckerindustrie,* again calls attention to the fact that the viscosity may play a certain part (which, however, is quantitatively not yet properly determined) in the formation of molasses and in the processes of crystallisation, but is by no means, as some imagine, the only determining factor. He instances, as an example, that molasses submitted to osmosis often possess a viscosity 50 per cent. higher than molasses not so treated, and nevertheless give good and regular crystallisation.

Dr. Claassen, in an article in the *Centralblatt f. d. Zuckerindustrie der Welt,* comes to the conclusion, based on his former and also some of his more recent valuable researches, that the viscosity is never the actual cause of the formation of molasses in the same sense as the chemico-physical effect of the non-sugars; to the influence of the latter is due the purity of the molasses, according to the quantity and kind of the non-sugars, and it is unalterable. On the contrary, the circumstances on which the viscosity depends—above all, the concentration and the temperature—can be determined and practically regulated, so that the most favourable conditions can be ascertained and applied with regard to crystallisation and to leaving behind a true molasses as the final mother-liquor in the shortest period of time. No conclusion can be drawn from the viscosity of a syrup as to its capability of crystallisation; very viscous and apparently intractable syrups crystallise, under altered and more favourable conditions, well and abundantly.

A paper by Dr. Claassen in the *Zeitschrift für Rübenzuckerindustrie* on the "Viscosity of Sugar Solutions and Syrups" is summarised as follows in the *Chemiker-Zeitung*:—

"Claassen has instituted very extensive and laborious researches on this important but hitherto almost completely neglected subject. The essential points of these can only briefly stated here. The experiments, proposals for the continuance of which on uniform lines are made by Dr. Claassen, were conducted by means of Engler's viscometer, as a rule the number of seconds required for running off 100 ccm. of solu-

tion being stated, but sometimes, however, a co-efficient is quoted having reference to the viscosity (V.)=100 of a normal sugar solution standard at 30° C., 100 parts of water containing 219 parts of sugar. The figures have no absolute, but only relative value, and refer principally to the viscosity (V.) of such saturated and supersaturated solutions of syrups as are most important in practical working. As regards the salts, the V. of the normal sugar solution is reduced, on addition of 2·5, 5, and 10% of these by only a few of them, such as potassium nitrate, potassium chloride, and acid potassium sulphate, but by most of them it is increased, and in increasing ratio by the salts of potassium, sodium, and calcium. Neutral salts act more energetically than acid salts, salts of weak acids more than those of strong, the greatest effect being exercised by the alkali carbonates, and by salts capable of taking up a large quantity of water of crystallisation, and thereby reducing the quantity of free water.

"As the corresponding salt solutions are in themselves scarcely more viscous than water, their influence must depend upon the formation of alkali-saccharates and their double compounds with salts. Still stronger than that of the salts examined is the action of the non-sugars contained in the molasses; this must depend either on the nature of the acids or on the presence of organic substances.

"An excess of cane sugar (in a less degree also of glucose and of invert sugar) has a greater influence than most non-sugars, and salts, non-sugar, and sugar increase the V. in proportion to the quantities added; hence V. increases in tolerably direct proportion to the decreasing purity and to the increasing supersaturation of the solution.

"As regards *temperature* (t.), V. falls—for the sugar-solution saturated at the temperature at which the experiments were carried out—with increasing t., and rises rapidly with increasing t.; in the case of supersaturated and impure syrups V. increases extraordinarily with falling t.; on the other hand, in the case of saturated and supersaturated and of pure and impure solutions at a high temperature, V. shows only slight variations, so that here the influence of concentration and the quality of the non-sugar becomes less marked. This is especially noteworthy as regards the conditions obtaining on boiling the sugar solutions and subsequently crystallising at a decreasing temperature,

"Alkalinity and acidity of the solutions do not perceptibly affect V, within such limits as are practically admissible.

"The assertion made by Steffen, Ranson, and others that juices heated with sulphurous acid are less viscous than ordinary ones is *not confirmed* by experiment, and must, therefore, be rejected as incorrect.

"In practical working the best and most economical way of restricting the viscosity consists in using syrups which are only slightly supersaturated, the runnings from which will also possess only a slight degree of viscosity."

EGYPT.

By W. Tiemann.

(Translated from the *Centralblatt für Zuckerindustrie.*)

In Egypt the cultivation of the sugar cane begins south of Cairo and extends to the Soudan. The land susceptible of cultivation is limited to a small strip on both sides of the Nile. The left bank affords a broader surface for cultivation, whilst on the east the bare terrace-like mountain range reaches in many places to the bank. Primarily, in this rainless country everything depends on whether the land can be irrigated or not. The system of canals is only sufficiently extended in a few of the larger *teftiches*, which are partly in European hands. On these better cultivated, larger estates, powerful and expensive pumping plants are employed for irrigation, which supply the necessary water for the plantations even when the water level is at the lowest point. In upper Egypt the formation of a number of large reservoirs by means of dams is at present being taken in hand. The carrying out of these projects cannot, however, be completed within less than eight or ten years. The largest of these undertakings—a monumental work, if it ever comes to completion—is designed to lay the whole province of Assouan under water when the Nile is at its highest level, so as to provide the necessary water for cultivation when the Nile is low. The cultivated land mostly consists of many metres of deep heavy Nile mud. The soil is heavier or lighter, darker or lighter in colour, according to the deposits. The transition from fertile Nile-alluvium to the sand and rock of the desert is very sharply defined. The soil lying at some distance from the bank mostly contains a large amount of salts, which are naturally especially injurious in the case of cane cultivation. In order to be able to grow cane on it these salts must be got rid of, as far as possible, by continuous

irrigation. In other respects nearly all the alluvial land is suitable for the cultivation of cane if it is protected from inundation and can be properly irrigated. The islands formed when the Nile is low are mostly used for the cultivation of corn, maize, melons, etc., crops which do not require periodical irrigation. The cane is generally planted during the month of March at the close of the campaign and cut eleven months later. The second year's cane then springs afresh from the roots. The cane is not allowed to stand longer than two years, the land is then ploughed, cleared from the roots and cultivated with clover (*berzim*), maize, and other field crops. At the time of high Nile the country is laid under water in order to fertilize it anew, whereupon it is replanted. Onions are frequently sown before planting the cane. These take only two months to ripen, and with the proceeds of this first harvest the planter can cover the expenditure for the cultivation of the cane. In many cases the cane is not allowed to grow a second time, but as a rule cotton and cane are planted in regular rotation year by year. Whilst the first year's cane, after the ground has lain fallow under Nile water for some time, yields, even without manuring, a fairly good harvest, the second year's cane requires fresh nourishment in the shape of manure. Up to now mineral manures have not been imported and applied, or only in very small quantities. Only that which is found in the country is used. In the first instance the ruined deposits from old cities and villages must be mentioned, the so-called *zebach adim*. They contain 5 to 8% of saltpetre, and also some potash. The Fellahin, that is, the native Arabs of the country, have changed their habits and customs but little from former times. They live penned up with their cattle in the dirt of their miserable mud-huts, and so produce their manure on the spot. In Cairo a firm, the "Société Générale des Engrais," has been established to explore the hills and ruins of old villages for saltpetre. The saltpetre found in layers in Upper Egypt, which for some years was so much talked about, contains in addition 30 to 35% of sodium chloride, and therefore cannot be used directly as it is. A manure much used is pigeon-guano, which is obtainable in sufficient quantities, and gives good results in the case of second year's cane. Even the caves and mummy-pits, which are on the border of the desert in the mountains, frequently contain valuable quantities of animal manure, and many a decayed mummy is taken out for manuring the fields, and thus enters again into the cycle of natural operations. The stools of the first year's cane also get a good food material for their new growth from

the burning of the leaves and cane tops remaining on the field from the first cutting. In connection with the Experiment Station here a large number of field manuring experiments were carried on last year with mineral manures, which however, were for the most part rendered nugatory by the unfavourable winter climate (violent storms in September and November, together with frost in the beginning of December); the eight to nine months' old cane was actually frozen, however strange this may sound for Egypt, the leaves being completely withered. Any further continuance of ripening and increase of the amount of sugar connected therewith, was thereby frustrated. The juice stagnated in the cane, and the physiological metamorphosis of the glucose into crystallizable sugar could not take place. The cane had to be cut as quickly as possible to save the harvest. The amount of sugar hence decreased during the whole campaign, instead of increasing. The curve indicating the amount of sugar shows the enormous difference; in 1896-97, an increase in the amount of sugar in the cane up to over 14·5% sugar (by digestion), whilst in this last campaign the amount of sugar fell below 10%. Fermentation and an acid smell were even perceptible in the field. On an average we may say, that the cane in Egypt when ripe contains, under tolerably favourable conditions of weather, 14% of sugar.

Average of the Daily Analyses during the Campaign, 1896-97.

Brix.	Sugar.	Non-sugar.	Quot.	Specific gravity.	Deg.	Glucose.
18·5 ..	16·21 ..	2·2 ..	87·6 ..	1·076 ..	13·99 ..	0·55

Average of the Daily Analyses during the Campaign, 1897-98.

Brix.	Sugar.	Non. sugar.	Quot.	Specific gravity.	Deg.	Glucose.
15·5 ..	12·72 ..	2·78 ..	82·0 ..	1·063 ..	11·02 ..	0·99

The analyses are of an average sample from a quantity of cane of from 500 to 600 tons, daily worked up. The sample was taken from the diffusion-cutting machine. The figures may, therefore, be regarded as good averages.

At the beginning of the campaign the second year's cane, which ripens first, is cut first, and then the first year's cane. This is quite perceptible in the sugar curve of 1896-97; in February the sugar content falls with the commencement of the cutting of the first year's cane, and only rises again with increasing maturity. It is essential

from the factory point of view that the cane should be cut at the right moment, on the completion of the sugar formation, which is not always done in Egypt.

The same price is paid by the manufacturer for low grade cane as for good, namely $2\frac{3}{4}$ piasters* per Cantar. Up to a few years ago the following buying scale was in force at the works of the Daira Sanieh:—

For Canes, with Juice Testing by the Hydrometer,

7·5 to 8·0 Beaumé	2 piastres per Cantar.	
8·0 to 8·5 ,, ...	$2\frac{1}{4}$,,	,,
8·5 to 9·0 ,, ...	$2\frac{1}{2}$,,	,,
9·0 to 9·5 ,, ...	$2\frac{3}{4}$,,	,,
9·5 to 10·0 ,, ...	3 ,,	,,

This arrangement was abandoned in consequence of the low price of sugar and other disadvantages, and the uniform price of $2\frac{3}{4}$ piastres was established in its place. It may safely be supposed that the factories do not suffer by either way of buying, especially considering the manner the Arabs attend to their business. On the other hand it will be quite clear that with the present mode of purchase the Arab does not trouble himself about producing a really good cane. Wilson Pasha, the chief engineer of the Daira, correctly suggests, in his article on the cultivation of the sugar cane (see *Sugar Cane* and *Hacendado Mexicano*) what is necessary to raise this—for Egypt most important branch of industry. Besides management, which must of necessity be of a scientific, chemical and technical nature, and a proper control, which is not yet introduced, the improvement of the position of these factories depends most materially on the quality of the raw material.

It depends on what quantity of sugar can be obtained from a given unit of land. Even the best soil becomes worn out in time by so exhaustive a plant as the sugar cane, and even the fertile matter of the Nile water cannot, in the long run, restore all that the cane takes from the land. A beginning has been made at Cheik Fadl, Upper Egypt, by a private company, with the assistance of an experiment station, to introduce a rational cultivation of the cane, and to improve the latter qualitatively and quantitatively.

* 24 Kirates = 1 Feddan = 4,200 sq. m.; 1 Hectare = 2·38 Feddan; 1 Cantar = 46 Kilo; 40 Fadda = 1 piaster = about $2\frac{1}{2}$d. (100 piaster = 20s. 6d.)

The first year, unfortunately, was not favoured by the weather; violent storms beat down the canes, and frost set in before the ripening, so that the field experiments, performed with much trouble and labour, did not allow of any definite opinion being formed.

I will, therefore, not enlarge on these frustrated experiments and their results. It was clearly seen, even during the growth attained, that the cane is capable of assimilating mineral manures, and that successful results may be obtained by their use.

(*To be continued.*)

UNITED STATES.

Drawbacks on Exported Refined Sugar and Syrups.

(Willett and Gray.)

The Treasury Department at Washington has finally fixed the drawbacks on refined sugar and syrups exported under the new tariff. All rates are less one per cent. The rates on sugar are based upon the duty which has been paid on the raw sugar used in the manufacture. In case 96° test raws are used the drawback will be 1·79c. per lb. less 1%. The rate applied to present prices of granulated, say, 4·72c., makes quotation of 2·95c. net for export, which is above the parity of refined sugars in Europe and Canada. We do not look for large exports of refined sugar unless conditions are very exceptional.

Extract from the official schedule follows:—

"When the exported sugar is 'hard refined,' commercially known as loaf, cut-loaf, cube, granulated, crushed, or powdered, testing by the polariscope 99·5 degrees or above and is refined wholly from one grade of raw cane or beet sugar, used separately, the rate of drawback thereon for each hundred pounds exported, and the corresponding charge on the record of importation, for the kind of raw sugar identified, shall be as shown in the following schedule for each degree of polarization, and for the fraction of a degree in proportion:—

SCHEDULE OF RATES FOR HARD REFINED SUGAR.

Refined from Raw Cane Sugar.

Polarization of raw sugar used. Degrees.	Rate of drawback per 100lbs. exported. Dollars.	Charge record of importation for each 100lbs. exported. Pounds.	Polarization of raw sugar used. Degrees.	Rate of drawback per 100lbs. exported. Dollars.	Charge record of importation for each 100lbs. exported. Pounds.
99	1·83	102·23	87	1·62	118·25
98	1·82	103·70	86	1·60	119·85
97	1·80	104·65	85	1·58	121·54
96	1·79	106·23	84	1·56	123·32
95	1·77	107·27	83	1·53	124·39
94	1·76	108·98	82	1·51	126·36
93	1·74	110·12	81	1·48	127·59
92	1·72	111·33	80	1·45	128·89
91	1·70	112·58	79	1·42	130·28
90	1·68	113·90	78	1·39	131·75
89	1·66	115·28	77	1·36	133·33
88	1·64	116·72	76	1·33	135·03
—	—	—	75	1·29	135·79

Refined from Raw Beet Sugar.

98	1·82	103·71	91	1·72	113·91
97	1·80	104·66	90	1·70	115·26
96	1·79	106·24	89	1·69	117·37
95	1·78	107·88	88	1·67	118·87
94	1·76	108·98	87	1·65	120·44
93	1·75	110·76	86	1·63	122·10
92	1·74	112·63	—	—	—

The drawback on soft refined sugar is in proportion to its test; say if testing 90° the drawback will be 90-100 of the rates on hard refined.

The drawback on syrup will be as follows:—

"On syrup valued at 3c. per gallon or less, 1½c. per gallon; on syrup valued above 3c. and not above 14c. per gallon, the drawback shall equal one-half the value of the syrup; on syrup valued above 14c. per gallon, 7c. per gallon.

"The values herein named are the values in tank at the refinery, in condition as thrown finally from the centrifugal in the regular process of sugar manufacture."

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; 322, High Holborn, London; and 118, New Street, Birmingham.

ENGLISH.—Applications.

26475. E. Luck and S. Gordon Luck, London. *Improvements in purifying and decolourising saccharine liquor.* 14th December, 1898.

26888. G. W. Haddox, London. *Improvements in apparatus for the delivery of sugar and other substances in measured quantities.* (Complete specification.) 20th December, 1898.

26981. W. Mather, London. *Improved means for evaporating and concentrating liquid solutions, and in obtaining solid substances from such solutions.* 21st December, 1898.

ABRIDGMENTS.

29286. Thomas H. P. Heriot, formerly of Berbice, British Guiana, but now of San Fernando, Trinidad. *Apparatus for separating suspended solids from liquids, for separating soluble from insoluble solid matters; and for partially separating insoluble solid matters of different specific gravities.* 10th December, 1897. This invention relates to the separation, by difference of specific gravity, of suspended solid matters from liquids—to the separation of difficultly soluble from insoluble solid matters; and to the partial separation of solid matters of different specific gravities. Primarily the invention is designed for the treatment of saccharine juices in the manufacture of sugar, but it may also be employed in lieu of filtration in manufacturing, metallurgical, and other operations generally, as for example, for effecting the rapid clarification of fermented and other liquids, for separating bulky precipitates in the manufacture of dyes, for the treatment of sludge in sewage works, and for concentrating free gold in finely crushed ore. As applied to the manufacture of sugar, the invention has for object to effect a more perfect separation of "mud" from limed juice, the "mud" being separated in a semi-solid condition, whilst the juice runs off bright and clear, and can pass to the "triple effect" apparatus without further treatment, thus enabling the subsiding clarifiers, re-subsiders, eliminators, and filter-pressers generally employed in the manufacture of cane sugar to be dispensed with.

28747. JOHN McNEIL, Govan, and JULIUS LEWKOWITSCH, Manchester. *Improvements in evaporating or concentrating apparatus.* 6th December, 1897. This invention has for its object to improve the construction and action of apparatus for evaporating or concentrating liquids, more especially such as when heated, deposit crystalline or other solid matters. The apparatus used comprises a closed metal vessel, the lower part of which has rotating in it a hollow corrugated drum heated by steam; brushes or scrapers or chains are provided for cleaning or scraping the drum.

1131. JAMES J. JOHNSON. (A communication by A. Verley, Courbevoie, near Paris.) *Improvements in the manufacture of sugar.* 14th January, 1898. This invention consists in an improved mode of effecting the purification of the juice of beetroot or sugar cane or other vegetable juices containing sugar, by means of which it is possible in a more convenient and expeditious manner to decolourise the juice and to remove from it organic impurities and odour. The process is applicable to such juice at any stage of its manufacture before it is decolorised, and even to molasses and like fluids when sufficiently diluted to permit of the use of the said process. The juice ia rendered slightly alkaline, either by the addition of an alkali or an alkaline earth, or by treatment with lime and carbonic acid. The degree of alkalinity which is preferred is about 0·2 grains per litre. It is then filtered and cooled to about 20° C. Ozone is then caused to bubble through the juice. The ozone at first combines rapidly with the organic matter, but after a time the action becomes less energetic, it is for this reason that the ozone should be made to pass in succession through several vessels containing juice, which are in turn cut off from its action when the ozonization is complete. The juice is then treated with a reducing agent, such as the zinc-copper couple of Gladstone and Tribe. It comprises a centrifugal drum having imperforate sides, a stationary casing enclosing the drum and a centrifugal distributing disc or cone, the drum having at top an overflow opening for the clarified effluent, formed in an inwardly directed circular flange, and at bottom a central discharge opening adapted to permit both the escape of residual liquid and its collection by the casing, means are also provided for the easy removal of the solid matters.

28589. J. J. HIGNETTE, Paris. *Process for the purification of saccharine juices and apparatus therefor.* 3rd December, 1897. All specialists are agreed upon the advantages which would result from a

defecation when cold, and an immediate separation of the precipitate produced by the action of lime in cane or beetroot sugar manufacture before the saturation is effected by means of carbonic, sulphurous or other suitable acids. But the difficulty of filtering defecated juices has hitherto rendered impossible this method of procedure. It is this process of defecation whilst cold that Mr. Hignette has obtained economically by means of various improvements which dispense with the operations known as the double or triple carbonatation. He uses small quantities of lime (2—5 thousandths), for purifying the juice and the drainings of centrifugals, the said limed juice being then introduced with or without carbonic acid into centrifugals having solid drums revolving at high speed in which, under the action of centrifugal force, the scum is deposited containing a large proportion of the organic substances, the said scum being removed in a continuous manner from the saccharine juice.

UNITED STATES.—Abridgment.

615893. Jean Perichon, of Rodah, Egypt. *Diffusion battery.* 13th December, 1898. This invention relates to improvements in the treatment of bagasse; and its object is to extract therefrom by washing the first or second passage through the roller-mills the largest possible amount of juice of the greatest possible density. The method adopted for this purpose, unlike the diffusion process commonly employed, enables the roller-mills to be made use of, and the apparatus and its operation to be simplified, and, while enabling working to be conducted with economy, insures a high yield.

616679. L. May, Vienna. *Apparatus for moulding masse-cuite.* 27th December, 1898. This invention consists in the combinations of mould-bodies and cores and appurtenances thereof, by which partly-fluid substances, such as the masse-cuite of sugar refiners are moulded into bars of a desired cross-sectional form and treated with chairce or any liquid clarifying agent.

GERMAN.—Abridgments.

98979. C. Pfeiffer, Wendessen. *Process for removing the refuse from diffuser vessels by means of compressed air.* 8th December, 1897. On removing the refuse from diffussion vessels, it happens that the liquid flows off faster than the diffusion refuse, so that a part of the latter sticks fast and does not leave the dffusion vessel. In order to prevent this, a pipe is inserted in the discharge passage, and the same, on being connected with a water system filled with water, so that a

counter-pressure is exerted, which prevents a too rapid discharge of the liquid.

99032. LEOPOLD MAY, Ungarisch Ostra. *Filter, with rebounding surface applicable especially to beet root juices.* 30th December, 1897. The pipe for admitting the liquid to be filtered opens out into the underneath part of the sieve, bodies forming the filtering surfaces and the rebounding body or cap is suspended over the mouth of the same. The liquid on entering rebounds against the same, and is dispersed radially, forcing thereby the refuse remaining behind at the bottom of the sieve against the side of the sieving materials, from where it is from time to time removed. The filtered liquid is discharged through a funnel.

99584. ALEX. KUMPFMILLER, Höcklingsen, near Hemer, and ERNST SCHULTGEN, Iserlohn. (Third addition to patent No. 90071, of the 16th February, 1896, and second addition to No. 97901.) *A water seal applicable for the apparatuses patented under above numbers.* 19th March, 1897. The insertion of open vessels in the stream of liquid circulating by means of an evaporator has already been described in the principle patent No. 90071, and in the additional patent No. 97901. The present invention describes another method of carrying the invention into practice whereby by making use of these open vessels a more ready discharge for the circulating liquid is attained, the lower end of the discharge pipe which in the patent of addition opened out under the surface of the liquid, being curved outwards in a manner resembling a syphon, thus forming a water seal.

99547. RUDOLPH BERGREEN, Roitzsch, near Bitterfeld. *Shredding press with woven wire casing.* 19th October, 1897. The latteral casing made from woven wire is provided with fish plate rails, which not only aid in strengthening the wire casing, but serve to fasten the connecting pieces so that the woven wire is preserved intact.

99585. H. PUTSCH & Co., Hagen i. W. *Apparatus for pressing beetroot and the like against the cutting cylinder of shredding machines.* 9th December, 1897. (Addition to Patent No. 99385, 11th November, 1897.) The arrangement protected under No. 99385, for forcing beetroot and the like against the shredding cylinders of shredding machines, is further improved in that the serrated or pointed cylinders are spring mounted, which preserves the knives of the cutting disc from coming in contact with hard objects, such as stones. The consequence of this arrangement is that the shaft, being spring mounted, when pressure is put upon it, is pushed outward upon the

lower points of the cylinder, so that the hard object incapable of being shredded can pass away.

99692. A. Bertram, Ustie, Russia. *Continuous acting diffusion apparatus.* 8th May, 1897. The beetroot shreddings are discharged out of two shredding machines through a common funnel, the body of the funnel being provided with conveying worm into a diffuser, and thence through a narrow neck-piece, also provided with a conveying worm, into a mash cylinder with a stirring apparatus, by which the shreddings are mashed without being triturated. They are then again passed through a worm, and then forced, under increased pressure, into a collecting receiver and an oblique conveyor pipe, narrowed towards its upper end, provided with two conveyor worms, whereby the water, which is carried along with the shreddings, is discharged through a perforated casing, the shreddings passing out at last from the conveyor pipe into a chamber prepared for their reception. The water effecting the diffusion without lixiviating the beet shreddings enters through pipes, and is by means of vacuum suction drawn through the whole apparatus; its passage being obstructed by the narrowing of the mash pipe, it is caught by a perforated casing, and passes direct through a preliminary heater into the centre of another mash pipe, its progress being again arrested by the sieve casing of the other narrowed opening; it then passes through another pipe and preliminary heater underneath the diffuser, and finally flows, being converted into raw juice, through a discharge pipe set apart for same. The shreddings and the water thus move in a direction counter to one another, and thus a complete systematic continuous lixiviation of the shredding is effected in one operation.

100432. Rudolph Bergreen, Roitzsch, near Bitterfeld. *Shredding knife.* 24th September, 1897. In order to render the crosspiece of the knife more durable, and to always produce perfect shreddings, a smooth after cutting knife provided with under cutting edges is arranged to work in co-operation with the crosspiece. The teeth of this lower knife correspond with the indentations of the front knife.

Patentees of Inventions connected with the production, manufacture, and refining of sugar will find *The International Sugar Journal* the best medium for their advertisements.

The International Sugar Journal has a wide circulation among planters and manufacturers in all sugar-producing countries, as well as among refiners, merchants, commission agents, and brokers, interested in the trade, at home and abroad.

IMPORTS AND EXPORTS OF SUGARS (UNITED KINGDOM).

To end of December, 1897 and 1898.

IMPORTS.

Raw Sugars.	Quantities.		Values.	
	1897.	1898.	1897.	1898.
	Cwts.	Cwts.	£	£
Germany	4,383,928	5,641,672	1,920,556	2,582,136
Holland	211,289	337,297	88,134	146,950
Belgium	1,173,157	1,489,074	500,842	690,114
France	2,751,951	2,039,542	1,312,111	1,026,341
Java	447,559	562,845	218,229	279,348
Philippine Islands	812,111	898,158	310,840	399,055
China, Hong Kong, &c.	200	....	130	....
Spanish West India Islands	21,320	14,380	11,046	8,108
Peru	847,659	1,002,197	425,661	513,074
Brazil	324,987	442,576	143,082	209,832
Mauritius	48,624	62,614	20,906	31,695
British East Indies	571,252	412,690	200,933	178,248
British W. Indies, British Guiana, & Brit. Honduras	1,057,909	906,195	652,489	564,273
Other Countries	901,581	883,666	418,012	421,961
Total Raw Sugars	13,553,527	14,692,906	6,222,971	7,051,135
Refined Sugars.				
Germany	10,119,034	11,323,874	6,143,813	6,946,089
Holland	1,738,678	2,297,155	1,160,382	1,483,309
Belgium	752,174	466,295	466,893	292,173
France	3,172,462	2,258,277	1,923,326	1,390,168
United States	13,861	7,780	14,205	8,459
Other Countries	34,550	66,016	19,354	38,428
Total Refined Sugars	15,830,759	16,419,397	9,727,973	10,158,626
Molasses	1,165,574	1,353,188	246,242	346,917
Total Imports	30,549,860	32,465,491	16,197,186	17,556,678

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden and Norway	105,762	105,516	61,978	62,889
Denmark	141,505	132,073	71,816	68,019
Holland	116,632	117,659	64,133	67,015
Belgium	17,872	17,958	9,815	10,316
Portugal, Azores, &c.	105,261	78,596	56,416	42,794
Italy	50,261	38,842	26,227	21,026
Other Countries	336,650	245,042	185,093	141,986
	873,943	735,686	475,478	414,045
Foreign & Colonial Sugars.				
Refined and Candy	216,412	269,759	134,593	155,381
Unrefined	403,886	378,794	213,708	213,591
Molasses	272,747	297,762	92,938	91,310
Total Exports	1,766,988	1,682,001	916,717	874,327

SUGAR STATISTICS.

Estimate of the Principal Cane Crop Exports.

(J. W. De Silva & Co.'s Monthly Report.)

	1898-99. Tons.		1897-98. Tons.		1896-97. Tons.
Cuba..................	*300,000	....	*258,000	....	*180,000
Porto Rico	50,000	....	54,000	....	54,000
Trinidad	45,000	....	52,000	....	55,000
Barbados	50,000	....	55,000	....	58,000
Jamaica	25,000	....	30,000	....	30,000
Antigua and St. Kitt's ..	20,000	....	25,000	....	29,000
Martinique	30,000	....	35,000	....	35,000
Guadeloupe............	35,000	....	40,000	....	40,000
Demerara	100,000	....	100,000	....	90,000
Reunion	45,000	....	45,000	....	48,000
Mauritius	160,000	....	120,000	....	150,000
Java..................	650,000	....	541,000	....	473,000
British India	10,000	....	20,000	....	28,000
Brazils................	125,000	....	175,000	....	185,000
Manila, Cebu, and Iloilo	125,000	....	180,000	....	202,000
United States..........	300,000	....	351,000	....	322,000
Peru..................	65,000	....	50,000	....	42,000
Egypt	70,000	....	60,000	....	65,000
Sandwich Islands	235,000	....	225,000	....	224,000
Total of Cane	2,440,000	....	2,416,000	....	2,310,000
,, Beet	4,860,000	....	4,825,000	....	4,916,000
Cane and Beet	7,300,000	....	7,241,000	....	7,226,000

* Crop available for export in each season.

UNITED KINGDOM.

Statement of Twelve Months' Imports, Exports, and Consumption for Three Years.

	1898. Tons.		1897. Tons.		1896. Tons.
Stock, 1st January	90,000	..	139,623	..	110,184
Imports, Raw Sugar, Jan. 1st to Dec. 31st	734,645	..	677,676	..	787,184
,, Refined, Jan. 1st to Dec. 31st ..	820,970	..	791,538	..	738,846
,, Molasses, Jan. 1st to Dec. 31st ..	67,659	..	58,279	..	38,829
	1,713,274		1,667,116		1,675,043
Stock, in 4 chief Ports, Dec. 31st	76,930	..	90,029	..	139,643
	1,636,344		1,577,087		1,535,400
Exports (Foreign, and British Refined) ..	84,100	..	88,349	..	84,477
Apparent Consumption for Twelve months	1,552,244		1,488,738		1,450,923

Stocks of Sugar in Europe at uneven dates, January 1st to 20th, compared with previous Years. In thousands of tons, to the nearest thousand.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	Total 1899.
72	995	645	622	215	2549

	1898.	1897.	1896.	1895.
Totals	2572 ..	2675 ..	2490 ..	2009

Twelve Months' Consumption of Sugar in Europe for Three Years, ending 31st December, in thousands of tons.

Great Britain.	Germany	France.	Austria.	Holland, Belgium, &c.	Total 1897-98.	Total 1896-97.	Total 1895-96.
1646	742	562	355	449	3754	3680	3430

Estimated Crop of Beetroot Sugar on the Continent of Europe for the current Campaign, compared with the actual crop of the three previous Campaigns.

(From Licht's Monthly Circular.)

	1898-99. Tons.	1897-98. Tons.	1896-97. Tons.	1895-96. Tons.
Germany	1,710,000 ..	1,852,857 ..	1,836,536 ..	1,615,111
Austria	1,040,000 ..	831,667 ..	934,007 ..	791,405
France	830,000 ..	821,235 ..	752,081 ..	667,853
Russia	750,000 ..	738,715 ..	714,936 ..	712,096
Belgium........	220,000 ..	265,397 ..	288,009 ..	235,795
Holland........	155,000 ..	125,658 ..	174,206 ..	106,829
Other Countries..	155,000 ..	190,000 ..	202,990 ..	156,340
	4,860,000	4,825,529	4,902,765	4,285,429

It will be observed that, as compared with the preceding month, the estimates are again increased, viz., for Austria by 40,000 tons; for France by 30,000 tons.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

The re-opening of our market after the New Year's holidays was characterised chiefly by want of animation and a market indisposition to purchase. A reduction has had to be submitted to in order to effect sales. The caution shown by refiners whose margin has been very small, and the refusal of the trade generally to buy for anything but immediate requirements were accentuated during the month by increased figures of production from France and Austria. A further source of weakness is the possibility that American refineries are for the present sufficiently well provided to allow them to hold aloof for some time yet from European purchases. The poor crop in Louisiana has produced no effect. It is believed that refiners in the United States are losing steadily at current prices, which are the result of the contest between the American Sugar Refining Company and the Arbuckle Doscher and other independent refiners. Czarnikow's Weekly Price Current says: "After the disappointments of the last few years, speculators and the trade in the United Kingdom are chary of going deeply into the article, and unless some unforeseen accident happens to the growing or prospective crops, the course of the market is likely to depend on the more legitimate effects of supply and demand.

The only hope of any proximate revival and accompanying advance in prices seems now to lie in the probable exhaustion of the invisible supplies, which must certainly be much reduced both in Europe and America, and in the fact that the visible supplies will not be large enough as soon as consumption resumes its normal rate of increase. We still maintain our doubts as to the Cuban crop even reaching 400,000 tons.

The following quotations are in all cases for prompt delivery:—

			Last Month.
Porto Rico, fair to good Refining	10/0 to 10/9	against	10/3 to 11/6
Cuba Centrifugals, 97°/ₒ polarization	11/0	,,	11/6
Java, No. 14 to 15 D.S.	11/3	,,	11/9
British West India, fair brown	9/9 to 10/9	,,	10/3 to 11/6
Bahia, low to middling brown	8/9 to 9/0	,,	9/3 to 9/9
,, Nos. 8 and 9	9/0 to 9/3	,,	9/6 to 10/0
Pernams, regular to superior Americanos.	9/0 to 9/3	,,	9/9
Madras Cane Jaggery	9/0	,,	9/3
Manila Taals	8/6	,,	8/3 to 8/6
French Crystals, No. 3, f.o.b.	10/9	,,	11/0 to 11/3
Russian Crystals, c.i.f.	?	,,	11/0 to 11/3
German granulated, f.o.b.	11/0	,,	11/0
Tate's Cubes	15/1½	,,	15/7½
Beet, German and Austrian, 88%, f.o.b.	9/4½	,,	9/7½

THE

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☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

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Exports from British Guiana from 1st to 30th January:—Sugar, 9,046 tons; rum, 2,795 puns.; molasses, 1,035 casks; cocoa, *nil;* against 15,460 tons; 3,633 puns.; 104 casks; and 3,888 lbs. respectively, for the like period last year.

The present number contains a rejoinder by Professor Harrison and Mr. F. J. Scard to Mr. and Mrs. Veley's monograph on the Micro-Organism of Faulty Rum. To our mind, the cardinal point in the whole discussion is the failure, *alike by Prof. and Mrs. Veley and Messrs. Harrison and Scard*, to produce "faultiness" by cultivating the microbe in rum, and until this can be effected we must consider as not proven the assumption that the micro-organism in question is the cause of "faultiness" in rum.

It would seem as if we must constantly hold ourselves prepared to unlearn a good deal of what has been hitherto taught as axiomatic truth. We are now told, on satisfactory authority, that living cells are not necessary to fermentation. The liquid contents of the cells are found to be able to produce perfect fermentation, in the case of

sugar more quickly than when yeasts are used. The processes of fermentation hitherto in use will now certainly undergo some modification.

Dr. F. Strohmer, of Vienna, who presides over the Central Laboratory of the Austrian Sugar Manufacturers, has recently published a memoir on the question whether there is any danger to the public health from the employment of barytes as a clarifying agent. He comes to the conclusion that it is perfectly easy, with proper care, to eliminate any trace of barytes, because of the insolubility of its salts. This was, of course, already tolerably well known to sugar chemists, the danger really consists in the possibility of some mistake, which owing to the poisonous nature of these salts would have more than usually fatal results. It is only fair to say that up to now no case of such poisoning due to barium or zinc salts has transpired or even been suspected. Still, with the introduction of so many systems which operate (optionally, at any rate) with barytes, zinc, and the like, it cannot be ignored that a certain amount of danger, not hitherto present, does exist.

We regret to have to chronicle the decease of an old and much valued correspondent of this journal and an esteemed personal friend, in the person of Mr. Henry A. Brown, the well-known sugar tariff expert, formerly a special agent of the United States Treasury Department, which office he held under several administrations. Up to a very short time before his death, at the age of 76, his advice and the results of his long experience were always welcomed by the officials charged with the drawing up and administration of the sugar tariffs, and his views on these subjects have always been most willingly placed at the disposal of the editorial department of *The Sugar Cane*. It is perhaps worth mentioning that Mr. Brown projected a few years ago the establishment of a sugar periodical on the same broad basis as our present undertaking, and was only prevented by ill-health from carrying out his project, and he fully approved of the step which the proprietors of this publication decided on taking.

Since our last issue one of the greatest of French sugar manufacturers and refiners has passed away, leaving behind him a fine record of constant occupation in the improvement of all processes connected with the industry. His enterprise extended itself also to Egypt, where the Company possess several factories.

We have received, by the kindness of the manager of the Cawnpore Sugar Works, Ltd., very full details of the steps taken to awaken the Indian Government to the danger to native industry arising from the importation of bounty-fed refined sugars, and we propose to give an abstract of these papers next month. The question is a most important one, and it seems difficult to conceive why the Government should hesitate to take the necessary measures by imposing a countervailing duty.

THE AGRICULTURAL CONFERENCE AT BARBADOS.

We have now received tolerably full accounts of this, the first Agricultural Conference, held at Bridgetown, on the 7th and 9th January, under the presidency of Dr. Morris, C.M.G., Imperial Commissioner of the Department of Agriculture in the West Indies. The various colonies interested were very fully and efficiently represented, as will be seen from the following list:—

Jamaica.—The Director of Public Gardens and Plantations (William Fawcett, B.Sc., F.L.S.). The Government and Agricultural Chemist (Francis Watts, F.I.C., F.C.S.). The Principal of University College, Kingston (Rev. William Simms, M.A.).

British Guiana.—The Government Botanist and Superintendent of the Botanic Gardens (G. S. Jenman, F.L.S.). The Government Analyst and Professor of Chemistry (Professor J. B. Harrison, M.A., F.I.C., F.C.S.). The Principal of Queen's College (J. A. Potbury, M.A.). Agricultural and Technical Chemist, Plantation Diamond (William Douglas, F.I.C., F.C.S.). Agricultural and Technical Chemist to the New Colonial Company, Limited (Frederic J. Scard, F.I.C., F.C.S.).

Trinidad.—The Superintendent of the Royal Botanic Gardens (J. H. Hart, F.L.S.). The Government Analyst and Professor of Chemistry (Professor P. Carmody, F.I.C., F.C.S.). The Inspector of Schools (R. Gervase Bushe, M.A.). The Principal of Queen's Royal College (W. Burslem, M.A.). The Principal of the College of the Immaculate Conception (Rev. W. Caroll).

The Windward Islands.—The Curator, Botanic Station, Grenada (W. E. Broadway). The Curator, Botanic Station, St. Vincent (Henry Powell). The Curator, Botanic Station, St. Lucia (J. C. Moore). The Inspector of Schools, St. Lucia (F. E. Bundy).

The Leeward Islands.—The Inspector of Schools for the Leeward Islands (F. H. Watkins). Dr. H. A. Alford Nicholls, C.M.G., M.D., F.L.S., Author of "Tropical Agriculture." The Curator, Botanic Station, Dominica (Joseph Jones). The Curator, Botanic Station, St. Kitts—Nevis (William Lunt).

Barbados.—The Island Professor of Chemistry in chemical charge of Sugar Cane Experiments (Professor J. P. D'Albuquerque, M.A., F.I.C., F.C.S.). The Agricultural Superintendent of Sugar Cane Experiments (J. R. Bovell, F.L.S., F.C.S.). The Acting Chairman of the Education Board (the Hon. W. H. Greaves, Q.C.). The Principal of Codrington College (the Rev. Canon Bindley, M.A., B.D.). The Head Master of Harrison College (Horace Deighton, M.A., F.R.A.S.). The Inspector of Schools (Rev. J. E. Reece, M.A.).

The President commenced his address by an allusion to the unsatisfactory condition of the West Indies and the consequent appointment of a very competent Royal Commission to examine into the question, which, after an exhaustive inquiry had presented a report containing valuable suggestions as to the measures to be adopted for restoring the prosperity of these colonies. The recommendations of the Commission had since then been adopted by Parliament, and a beginning been made in giving effect to them by the establishment of a Department of Agriculture for the West Indies, the duties of which were twofold: (1) to endeavour to restore the sugar industry to a condition in which it could be profitably carried on; (2) to encourage the establishment of other industries in such colonies as afford suitable conditions to supplement the staple industry. The funds at the disposal of the Department up to the end of the parliamentary financial year were stated to be £6,500, and it was estimated that the annual provision in future would be £17,500, which it was confidently anticipated would be maintained as long as required. We welcome Dr. Morris's opening remark that "the Agricultural Department is specially charged to assist the sugar industry wherever the conditions are favourable for its continuance," and that "it is a cardinal point in the policy of the Department to prevent, if possible, a single acre of land now under cane from being thrown out of cultivation." The following observations are especially worthy of note:—

"There are in the West Indies certain Colonies in which the cultivation of the sugar cane has continued for a long period to be the staple industry. These may be termed Sugar Colonies. These are British Guiani, Trinidad in part, Barbados, Antigua and St.

Kitts—Nevis. The others, namely Jamaica, Grenada, St. Vincent, St. Lucia, Dominica, Montserrat and the Virgin Islands, although at one time and still to some extent dependent on the sugar industry have found themselves quite unable to withstand the keen competition of recent years. If they are to exist at all they will have to depend on other industries than sugar."

Dr. Morris has, from former residence in the West Indies and his further experience gained when attached to the Royal Commission, so full knowledge of the circumstances that we do not venture to criticise this division of the Colonies concerned, but we question very strongly whether the Jamaica and St. Vincent sugar planters will give up their sugar factories without a tough struggle, and they should have all the assistance that the mother country can give in their very legitimate endeavour to keep up with the competition and maintain their existence. Dr. Morris next proceeded to emphasize the fact that as there was little expectation of higher prices for tropical produce, the utmost importance must be attached to improving the quality of the cane, and he dwelt on the encouraging results recently obtained in Demerara, Barbados, and British Guiana, with a capital object lesson in the shape of a sheaf of the latest improved canes raised at Dodd's Botanical Experiment Station, the B. 147, which has much surpassed all the varieties hitherto planted in Barbados. He then indicated the course that would be taken in continuing the experiments hitherto carried on in several of the islands, turning eventually to the absolute necessity of the adoption of the most modern methods of extraction and manufacture, declaring, and this is probably a perfectly correct statement of fact, that in the smaller islands, apart from the heavy loss due to imperfect crushing, the loss from bad methods of manufacture amounted to one fourth of the total production. A remedy was suggested for this by the Royal Commission, and one of the papers to be read for discussion at that Conference dealt with that remedy, viz., the establishment of Central Factories. The concluding paragraphs of this portion of the address were as follows:—

"The time has evidently arrived when it is absolutely necessary for the planters to decide what the future of the sugar industry in these islands is to be. In commercial, as in natural life, the perpetual struggle for existence necessitates continual adjustment to new and fresh conditions. When this adjustment is wanting or imperfect the industry, or being, is pushed aside and disappears. It is now

imperative for the sugar planters to adapt themselves to the conditions of their environment or they become "unfit;" in other words, they will be unable to hold their own and they and their industry must disappear.

"With your permission I would touch upon one or two other points. Rule of thumb methods, wherever existing, must be abandoned and with them must be abandoned the crude and empirical notions in regard to agricultural subjects that have long since been discarded by our rivals amongst the intelligent communities of Europe and America. A simplification of methods for working sugar estates as well as for disposing of the produce (already adopted in some instances) is also necessary. This should tend to reduce the costs of management and, further, should enable the planters to obtain all estate supplies at reasonable prices.

"Formerly, when the price of sugar was high, it was possible for the industry to bear charges that are now impossible. Times have changed and simple and more direct methods, all culminating in reducing expenses, must now be adopted, otherwise West Indian sugar will have no chance of competing successfully in the markets of the world."

Dr. Morris next proceeded to refer to the further object of the establishment of the Agricultural Department, the promotion of other industries which should in some cases supplant and in others supplement the sugar industry, quoting the remarks of the Royal Commission on this point, of which perhaps the following extract supplies the gist:—
"Whilst therefore the vital importance of the sugar industry to the "present prosperity of nearly all the colonies is beyond dispute, we "wish to observe that so long as they remain dependent upon sugar, "their position can never be sound or secure. It has become a "commonplace criticism to remark upon the perpetual recurrence of "crises in the West Indian Colonies, and we submit that the repeated "recurrence of such crises, as well as the fact that the present crises "is more omnious than any of the previous ones, illustrates the "danger to which we have referred, and add much force to our "recommendations for the adoption of special measures for the intro-"duction of other industries." The closing remarks of the address on this branch of the work of the new department must be quoted in full, as illustrating the thorough grasp of the situation which Dr. Morris is able to take:—

"The object of starting other industries is first of all to realize to the best advantage the extensive tracts of unused lands in these islands; and, secondly, to find remunerative employment for people who are now almost without the means of subsistence. Other industries are therefore essential.

"In taking up this work I fully realize the difficulties of the situation. I am also sensible of the enormous amount of labour involved, and the slow and tedious character of the operations necessary to produce results at all commensurate with the cost of the undertaking. I have, however, a close acquaintance with the circumstances of these colonies. I have carefully studied their resources and I am not unused to deal with what is termed the 'labour difficulty.' In spite of these I retain, after an experience of twenty years, a strong faith in the future of these colonies; and I believe that rightly guided and assisted in these days of their adversity they will realize the destiny designed for them by nature and they will yet become happy and prosperous communities."

"It is needless to enter into details. The work immediately at hand is to give attention to the sugar industry. When efforts are fully started in that direction, then I hope within a short time to devote the energies of the department and the funds at my command in building up those other industries which the exceptionally able men on the Royal Commission regarded as essential to the permanent well-being of the West Indies."

The President then proceeded to state details of the arrangements for continuation of the sugar cane experiments where existing, and the establishment of further means of obtaining this end. In Barbados, Mr. Bovell and Professor d'Albuquerque have been placed in charge respectively of the field and chemical work. There will be four principal or central experimental stations and eight local stations in the island. In Trinidad the experiments hitherto proceeding will be continued, probably on an increased scale, by Mr. Hart, who has already done capital work in this direction. Similar arrangements are being made in Antigua, St. Vincent, &c. As to British Guiana, Dr. Morris was unable to give definite information as to what is likely to be done there, as the Government of that colony has under consideration a proposal to provide funds, as advised by the Royal Commission, for continuing on a large scale the experiments which have already produced such good results, and have been for some years recorded more or less fully in *The Sugar Cane.*

The address closed with very full references to the appointment of efficient agricultural instructors, the holding of agricultural exhibitions, the introduction of agricultural teaching into primary schools, higher schools, and colleges, the establishment of agricultural schools, dealing with fungoid pests, and improved steamship communication.

We hope to reproduce on some future occasion, in whole or in part, some at least of the papers read at this and the next day's meetings.

ON SOME NEW PROCESSES IN OPERATION DURING THE SEASONS OF 1997 AND 1898.

Of these, which have already been treated on to some extent in a paper on modern methods of refining, in the *Sugar Cane* for July, 1898, probably the most distinctly successful has been the Grossé process, originally inaugurated in Russia, and in operation during the last campaign of 1897-98 in no less than eight German factories. Its object, which appears to have been fully attained, is the production from the runnings from the first centrifugalling of white sugar and molasses in one operation, in the short period of from two to two and a half days. Up to now, the only serious objection which has been brought against it is the comparatively high cost. It is probable that some modifications will eventually be made in this process, but it may be considered unequivocally the most interesting and sucessful of all similar processes that have lately been brought out. Full details can be obtained from Messrs. J. Blancke & Co., of Brussels, and of No. 6, Rue de Pelletier, Paris. Already it has been decided to adopt the process in two French, three German, three Russian, and two Dutch factories, and in one each respectively in Spain, Switzerland and Italy; and also in Henry Tate & Sons' refinery in London. The eminent Director of the great Halle refinery, Dr. von Lippmann, at a meeting of Sugar Manufacturers held at Halle, on the 15th December last, spoke in decidedly favourable terms of this process, and said that in individual cases molasses of as low as 57° purity had been obtained. See an article in the present number on some results obtained with the Grossé process.

The Say-Gramme process of clarification by electrolysis, effecting in one operation the purification which at present is only obtainable by several (see *Sugar Cane* for June, 1898), has had some preliminary trial at the Piesdorf factory (Germany). The results are not such as

can profitably be discussed, inasmuch as no figures are given. The clarification is said to have been so far satisfactory, but the arrangements are to be altered with a view of dealing with an increased quantity. Comment is out of place at present, because we have not even now anything further to go on than when the process was first made public. We have always considered electrolytic clarification a possibility, but cannot forget the great danger of inversion in using such a powerful agent.

The Ranson process (see *Sugar Cane*, 1898, pp. 345 to 350) is again being declared a complete success as regards purification and rapidity of working. The German representative of the company, writing to the *Deutsche Zuckerindustrie*, gives figures showing a progressive improvement in purity, and a decline in the non-sugars, viscosity being diminished, and the time for centrifugalling shortened by about one-third. On the other hand, no less an authority than Dr. von Lippmann declares that there is no material variation between the raw sugars produced at the Löbejün factory, whether they have been subjected to the Ranson process or not, so that we are left irresolute. Many statements have been made respecting the results obtained by this process, but in nearly all of them we find one important element wanting, viz.: definite and full figures with regard to the quantitative yield, and this is a defect which will have to be remedied before a distinct conclusion as to the real value of the process can be arrived at. In some results, given in the *Deutsche Zuckerindustrie* last year, a diminution of viscosity and an increased yield of fine sugar, amounting to 0·5, are said to have been obtained, a great decline in the purity of the juice being noticed between the first and second sugars, which does not appear to have been clearly explained. Sachs and Weisberg assert that neither improvement in the juice nor reduction in the quality of the molasses being ascertainable, it is difficult to see on what we can base the greater yield said to be obtained. One French sugar chemist declared that he has obtained by the simple use of sulphurous acid alone, results equal to those promised by the Ranson method. The *Sucrerie Belge* says it is not sufficient simply to state that the process gives a higher yield, this must be demonstrated by a complete chemical control, and notably by a chemical analysis of the molasses. Mr. Horsin-Déon, the eminent French engineer and chemist, speaks very highly of results observed by him in a Russian factory, which he states as considerable decolorisation of the masse-cuite, diminution of the time required for

centrifugalling, a brighter and whiter product, and a higher yield of first sugar, *estimated* at three per cent. This word "estimated" spoils the whole. It is too vague a term in matters of the kind, but Mr. Horsin-Déon must be regarded as no mean authority. On the whole, it seems almost impossible to pronounce a definite opinion, when the "doctors disagree" to such an extent. An objection to the system which we cannot altogether overlook, is the use of such substances as barium and zinc, the salts of which are so poisonous.

As regards the Loeblich and other patent processes of manufacture in which certain quantities of the green syrup resulting from one or other centrifugalling, usually the first, are again returned into the working after being treated at temperatures of from 60° C. to 100° C., everyone admits that there are defects in the systems, though each inventor claims that they do not exist in his own. That good results can, however, be obtained by judicious re-introduction of restricted quantities of these green syrups, seems to be undoubted, though it is said that the method will only succeed in case of really fine quality beets, but the real gain would appear to be only limited. Dr. Hertzfeld declares that a not unfrequent result is the development of certain substances which have the same effect as raffinose, increasing the apparent polarisation without there being present the quantity of sucrose which the figure of polarisation would indicate.

A process for hindering the production of too fine crystals in the vacuum pan or re-dissolving them when formed has been patented in Russia and elsewhere by a Mr. Carl Abraham. It is asserted that it is more applicable in the case of the raw material worked up in Russia than elsewhere. Dr. H. Winter, in Java, has invented and patented a process for attaining the same objects, which appears to have given very satisfactory results.

An invention which should not be left unmentioned is the "Brasmoscope," obtainable from Mr. E. Walcher, Avenue de la Reine, 160, Brussels. By means of this it is possible to ascertain the density of any syrups during the process of boiling and so to regulate to a nicety the concentration required, which is evidently a very great advantage in all phases of sugar boiling.

A successful system of washing cane-bagasse to extract all the sugar, full details of which, with illustrations were given with the *Sugar Cane* for May last, has been further improved and the modifications were patented last November in Egypt and elsewhere by the inventors, Messrs. Greig & Wilson, of St. Dunstan's House,

Idol Lane, E.C.; respecting these we shall have more to say in the course of a few months.

A system of clarification applied to cane juice, the invention of an American, Mr. E. W. Deming, of New Orleans, must be considered as one of the greatest successes of late years. Already a large number of these apparatus, in one form or another, have been erected and so satisfactory have been the results obtained that in many cases duplicate orders have immediately followed, on several estates three and four of the installations having been consecutively put up. We would refer those interested to the account of this system to be found in another part of the present number, and we believe it is likely to be very generally adopted in the new factories about to be erected in Cuba.

The Lillie System of Evaporation (The Sugar Apparatus Manufacturing Co., 328, Chestnut Street, Philadelphia) is also meeting with great approval, and is likely to be extensively adopted in new works in Cuba, &c. One special merit of this apparatus is that the capacity of any plant once installed can be very largely increased at a comparatively small cost by a very ingenious arrangement for enlarging the existing evaporating vessels.

The sums accruing to the French Treasury from the tax on sugar are stated to be as follows:—

	Fr.		Fr.
1892	203,973,341	1896	192,717,645
1893	194,876,328	1897	185,520,476
1894	195,984,810	1898	184,500,000 (?)
1895	189,280,614	1899	186,494,900*

The *Deutsche Zuckerindustrie* says the manufacturers of saccharine are becoming more audacious than ever in their assertions. Hitherto they had contended themselves with styling their productions "non-injurious," but now we find in the prospectus of an Elberfeld firm, "Sykose is the *most wholesome* of sweetening agents;" in the advertisements of Fahlberg & Co., "Saccharine-Tablets, the *most wholesome* sweetening substance;" in an advertisement of another firm, "Zuckerin is *more digestible* than sugar"!

* Assumed receipts.

THE MICRO-ORGANISM OF FAULTY RUM.

By V. H. Veley, M.A., F.R.S., and Lilian J. Veley (*née* Gould.)*

A REPLY.

We have received from the authors a copy of this monogragh, the first twenty-one pages of which are largely devoted to attacks on our paper published in Vol. XII of *Timehri* Part I. and in the *Sugar Cane*, Vol. XXX pp. 410 et seq. These attacks are evidently intended to minimise the fact that the authors of the monograph have failed to make their organism develope in rum.

If the attacks were fair ones and not misleading statements and misrepresentations of the results given in our paper we should have no grounds for complaint. It is the first time we have known of scientists of standing and repute resorting to such methods. We cannot allow such misrepresentations to pass unchallenged.

One of the first notices contributed by the authors of their discovery appeared in the *Sugar Cane*, 1897, p. 350, in which they stated that they had discovered "a bacterium which not only lives but multiplies rapidly in certain samples of rum" and in accordance with this, on page 4 of their recent work they state "continuous examination showed that the organism in samples of recent importation was dividing actively," while on page 10 they state "its power of multiplication by division soon becomes latent in the spirit" and on page 11 that "it cannot be supposed that the organism is existing in favourable conditions in rum of such alcoholic strength"—strikingly different conclusions.

On page 5, as a proof that their results are acccurate, they state "The proprietors of one of the estates, who received from us a report on the subject, have advised us that their crops since made have been practically sound, while those of other manufacturers have been even more faulty than before. Further comment appears superfluous." Those not cognisant of the facts of the case might agree with their conclusion, but the true facts do not support it. It is well known that during the last two years complaints about "faultiness" have rapidly decreased in number, not alone in connection with the estates which belong to proprietors who have consulted the authors of the work, but also with the majority of estates in the colony. This has certainly not been due to the adoption of precautions suggested by

* See January No. of this Journal, pp. 45-46.

Mr. and Mrs. Veley, but to much more obvious causes. We are not aware that on any estate in this colony have precautions suggested by them been adopted. In fact their alleged discovery has received practically no recognition from the planters of the colony.

On page 8 appears a list of the samples examined, with the dates of their importation. This list furnishes us with proof that, with one exception, a sample noticed in our preceding paper, the rums tested by Mr. and Mrs. Veley were distinct from any which we have received and examined.

On page 9 we find the admission, that "the presence of the micro-organism always accompanies the turbidity or faultiness is of itself no proof that the former is the sole cause of the latter," and later experiments are adduced to show that both undiluted and diluted faulty rum can be converted into sound samples by withdrawing the organism, and that sound rum could be converted into faulty rum by adding it.

As we have pointed out elsewhere, the experiment of filtering diluted rum has no bearing on the question as to whether or not the faultiness is due solely to the presence of the microbe. The filtration of the undiluted rum in which it is claimed that the faultiness was removed by the process, apparently was only carried on with one sample of rum, and it is rather a bold assertion from this single experiment to claim that the sole cause of faultiness of rum lies in the presence of the microbe. We have not been satisfied with filtering one sample, but have filtered numerous samples, using in each case all possible precautions against error, with results which do not agree with those quoted with regard to this single experiment.

The next experiment described appears to us to be a very weak one. Here we are told that a "pint bottle of undiluted faulty rum" was passed twice through a filter and that the "sediment" left on the filter was transferred to an equal bulk of sound rum contained in a similar bottle. If this were all that was done the experiment would not be amiss, but in order to make certain that the result should agree with their theory, the experimenters scraped off and added to the sound rum a deposit adherent to the interior of the first bottle! Comment on such a proceeding is unnecessary.

The authors assume (on page 9) that we filtered our samples only once in any case. This assumption is quite incorrect, and besides, its introduction does not add in any way to the strength of their case. In each instance the filter used by us, a Pasteur-Chamberland candle,

was cleansed, a very necessary precaution, by passing through it pure diluted alcohol containing 90 per cent. of absolute alcohol as long as it became coloured and until the filtered spirit ceased to become opalescent on dilution with water. The filter was then sterilised and the spirit to be tested passed through it. We used a much lower pressure than did the authors to obtain filtration. Some samples were filtered once, several twice or oftener, and one four times without altering the result. As a proof of the efficiency of our filtrations the undiluted rum when filtered gave a filtrate which became turbid on dilution with water, and this diluted filtrate when itself filtered the same filter became absolutely clear. (*Sugar Cane*, loc. cit., p. 415; *Timehri*, loc. cit., p. 8.)

The authors next give a quotation from Professor Hansen's work which does not appear relevant to their assumption. Hansen in it is alluding to the necessity of sterilising filters at short intervals owing to the microbes gradually in course of time growing through the pores of the substance of the filter. Here each filtration occupied only a short time and such growth was not possible. Double filtration is really only necessary in cases where the filter is not of sufficiently fine texture to at once retain the microbes and where the rate of filtration is unduly accelerated by excessive pressure.

The authors do not notice a phenomenom which we have found has always accompanied the filtration of coloured rum through Pasteur-Chamberland filters, that much of the colouring matter is retained by the filter and in consequence the colour of the filtered rum is materially reduced. If the filter can remove from solution and retain colouring matters of high molecular weights, as ours does, is it likely that it would fail to remove bacteria of such unusually large size as "Coleothrix methystes" is described to be?

On the same page (10) Mr. and Mrs. Veley describe the failure of their efforts to inoculate sound rum with "a few colonies of the micro-organism," and notice similar failures on our part. Here the weakest part of their attempted proof of their theory becomes apparent. We were led by them to believe that the micro-organism "not only lives but multiplies rapidly" in rum, now we are told that "its power of multiplication soon becomes latent in the spirit" and that "it cannot be supposed that the organism is existing in favourable conditions in rum of such alcoholic strength. No person of experience in horticulture would sow seeds on a cinder path and expect to obtain a good flower-bed." A reference to page 7 shows that in sample XVI.

the authors claim to have found "enormous quantities of cocci" and in sample XIV. "Plenty of large groups of cocci" and the micro-organisms appear to have been equally plentiful in samples V. and VI. In these cases the "cinder path" appears to have been fairly fertile!

Remarks are next made with regard to our having added 10 per cent. of faulty rum to sound rums, and it is assumed that we did so in order to at once produce faultiness. This is not the case. Reference to our paper (p. 4 of *Timehri*, vol. xii., part I., and p. 412 of the *Sugar Cane*) shows that this proportion of faulty spirit was added in unsuccessful attempts to inoculate sound rums with the organism, and that ample time—weeks, in fact—was allowed for development.

Later, on the same page, they state "that Messrs. Harrison, Scard, and Daniels performed similar experiments with the same negative results, and arrived at the hasty conclusion that the organism was dead." The conclusion we arrived at, not hastily but after full consideration, was "that the rums from which the sediments had been obtained were *free* from the spores of the organism, or else that the organism and any of its spores which *might* have been present in the original rum were dead." This is a very different view from that stated in the monograph.

Mr. and Mrs. Veley next indulge themselves in an attempt to vilify that portion of our work which confirmed theirs, thus clearly indicating the animus which moved them whilst writing this portion of their book. They assume that we neglected the precautions which even the veriest tyro in this class of work observes. This is not a fact; every vessel used by us in attempting to inoculate sound rum, so as to render it faulty, was sterilised, even the "stoppered bottles," and the latter, which were of the best quality, were protected, after introduction of the sterilised stoppers, from any accidental contamination by a layer of vaseline rubbed over the junction between the neck of the bottle and the upper part of the stopper. But the introduction of this assumption by Mr. and Mrs. Veley is entirely beside the question; the experiments were being carried on with a liquid which is, as far as our present knowledge goes, antiseptic to all micro-organisms other than the remarkable one discovered by Mr. and Mrs. Veley. Also, the results were negative, and hence the question as to whether or not the vessels were sterilised *cannot affect the conclusion.*

Further in the same paragraph another attempt at misrepresentation occurs. Here we find a paragraph quoted from our paper, the context being suppressed. This suppression was probably due to the context offering an explanation of why micro-organisms are more likely to be discovered in faulty rather than in sound rum. Possibly, however, the introduction of this misrepresentation here was merely for the purpose of enabling the authors to give us the highly interesting, though somewhat irrelevant, personal information, that one of them is "a director and part proprietor of a large and successful brewery."

On page 12 the authors state "he finds its (the microbe's) 'apparent remains' in the sediment," and then inform us that they are not able to "enter into Mr. Harrison's frame of mind, when in one passage he definitely states (p. 412) that he found the organism described by us, while in another (p. 414) he refers to it as the 'alleged bacterium.'" We must here again protest against misrepresentations on the part of the authors; we have not stated that we found the apparent remains of their organism in any sediment, but "the apparent remains of various microscopic organisms;" we did not "definitely state" that we had found the organism in any particular sediment, but that in one sample we found "among others an organism apparently similar to the one described by Mr. Veley." The expression "alleged bacterium" appears in a description of an experiment made with the sediment obtained from a large quantity of dilute faulty rum, in which we could not find the organism, but which Mr. and Mrs. Veley's theory requires to consist solely of it. We are certain that any careful reader, other than Mr. and Mrs. Veley, of the paragraph in which it occurs will not fail to enter into our "frame of mind" when writing it.

On page 13 the authors state that the milkiness in the second portion of a distillate from rum "probably consisted of compound ethers with water," and assume that this probability proves "the absence of any substances in the nature of a terpene." To the majority of chemists the milkiness of the distillate would rather indicate the possibility of the presence of a terpene than prove its absence. We do not know of any compound ethers present in rum which could give rise to this milkiness. As a rule, the milkiness of such distillates is due to the presence of high or fatty acids in minute traces in the rum, and is an occasional cause of faultiness in spirits, both uncoloured and coloured, in cases where the rum has inadvertently been contaminated with low products, or where, from faulty

fermentation, a larger portion than usual of these has been formed in the wash.

On page 14 we find an instance of unpardonable misrepresentation made apparently in order to discredit an experiment which we described, the results of which, in our opinion, are fatal to Mr. and Mrs. Veley's claim that their organism is the cause of the faultiness in rums. Our paragraph under consideration, on p. 414 of the *Sugar Cane*, and on page 7 of the *Timehri*, commences:—"If, instead of adding alcohol to the cloudy *dilute* 'faulty' rum, it is allowed to stand, and the clear upper liquid poured off, the sediment may be collected, and will be found to be very easily soluble in alcohol of from 40 to 50 O.P.," and further describes how this experiment was made, using about six litres of faulty rum. It was shown that the sediment obtained "dissolved, or otherwise disappeared" in strong alcohol, passed through a Pasteur-Chamberland filter, and then again became visible on dilution of the filtrate with water. This experiment the authors apparently considered had to be discredited if possible, as it supplied direct evidence of the incorrectness of their theory in the cases of the rums examined by us, and with this object they have ignored the word "dilute" in the first sentence of the above quotation.

On page 17 the authors state that "for at least fifteen years . . the wood used for puncheons, vats, etc., has been constant." This is only true to a certain extent, the qualities of the wood, where of the same kind, vary very greatly with respect to age, mode of preparation, etc. Experiment has shown to us that this is especially true with regard to the extractive matters yielded by the wood of the staves to alcohol, some kinds yielding much, others less, while specially prepared staves, such as have been used to a considerable extent in Demerara during the past year or eighteen months, give up practically inappreciable amounts. This latter property of steamed staves is well known to distillers of silent spirit.

We may point out that where Mr. and Mrs. Veley have failed to obtain evidence of the presence of resins in rum, the tests used were quite inadequate to reveal their presence, save in comparatively large quantities, and the fact of their not finding them in *one* sample of faulty rum does not prove their general absence.

On page 21 there is an attempt to insinuate that one of us (Mr. Harrison) has been guilty of the contemptible act of suppressing the results of the examination of "large masses of the organism"

received by him. This statement he indignantly denies; it is absolutely false and without the slightest foundation. No such masses have been received by either of us, and we referred in our recent paper to all samples of faulty rum examined by us before writing it. The only samples examined since, and not referred to in the *Sugar Cane*, have been from rums from distilleries under the control of one of us; the cause of the faultiness in them has been discovered, traced to its source, and the trouble remedied. As in these cases the cause of the faultiness was volatile, and distilled over with the spirit, it is scarcely necessary to assure Mr. and Mrs. Veley that it was not their microbe. The introduction of such baseless charges into their monograph clearly shows the spirit in which the earlier part of the work has been written.

We have to thank Mr. and Mrs. Veley for the kindly advice offered to one of us in the concluding paragraph of Chapter III. on page 21, but as it has a strong family likeness to the penultimate paragraph of our paper (page 416 of the *Sugar Cane* and page 10 of *Timehri*), it is, we submit, advice of a wholly "tu quoque" nature.

With regard to the latter portions of their work (pages 22 to 58 inclusive) we have nothing beyond admiration to express. We notice with interest that the authors employed with success for the staining of their microbe the same stains (gentian violet and corallin, prepared by Grübler, of Leipsic) which, in our hands and in those of Dr. Daniels—who is at present one of the members of the Imperial Commission appointed to inquire into the micro-organisms of malarial fever in India, Africa, and elsewhere—proved quite inoperative to detect any micro-organisms in the majority of the sediments from the faulty rums examined by us.

J. B. Harrison.
F. I. Scard.

According to Licht, the present consumption of sugar per head in the United States is about 59 lbs., that of the United Kingdom nearly 91 lbs.

In Mexico the Compañia Azucarera del Pánuco has been formed, with a capital of 1,000,000 Mexican dollars, for the erection of the first Central Factory in that country, on an estate of 7,500 acres. The factory will grow cane as well as purchase it from farmers.

BOUNTIES ON SUGAR.

The following is the text of the further letter of the British Sugar Refiners' Committee addressed to Lord Salisbury, referred to in our editorial remarks in last month's issue:—

My Lord,

Foreign export bounties have such an important bearing on the most-favoured-nation clause in our commercial treaties, that I venture to submit to your Lordship the views of my committee on this point, more especially with reference to the new commercial treaty with Germany, and the form which this clause should take if foreign bounties, as we venture to believe, are no longer to be permitted to frustrate the intention of a stipulation professing to give an equality of treatment which is impossible so long as bounties are allowed to destroy it.

The admission of sugar receiving a bounty on the same terms as sugar receiving no bounty has much the same effect as levying a duty on the latter while freely admitting the former. A clause defining most-favoured-nation treatment should therefore, if it is to secure its object, specially except from its provisions all goods receiving any direct or indirect bounty which may enable them to obtain such an advantage when exported.

The clause should also provide a means of neutralising this effect of bounties, and of thereby restoring the equality which it aims at securing. There is the strongest practical necessity for this, because, during the long negotiations for the abolition of these bounties, it has frequently happened that the contracting Powers would have agreed to a Convention if they had received the necessary security that they would no longer have to compete in British markets with sugar receiving a bounty. The Convention has broken down on this point because Her Majesty's Government have declined to accept the proposal. The question was, however, thoroughly examined by the Select Committee of the House of Commons on Sugar Industries, and the Committee reported that there was, in their opinion, no theoretical or practical objection to such a course, except that, as they were informed by the Foreign Office, the most-favoured-nation clause in our commercial treaties, in the opinion of the law officers of the Crown, precludes us from giving this security, so reasonably asked

for by the foreign governments, and without which it would be impossible for them to agree to abolish their bounties.

The present position is, therefore, somewhat remarkable. On the one hand the bounties frustrate the intention of the most-favoured-nation clause, while, on the other, this same clause is declared by the Report of the Select Committee to be the only real impediment to their abolition, because its provisions prevent us from giving to the foreign governments who are willing to abolish bounties the security without which it is impossible for them to do so.

For these reasons we venture to urge upon your Lordship the necessity of making such provisions in new commercial treaties as will enable Her Majesty's Government to surmount the only remaining practical obstacle to the abolition of the bounties.

In urging this we are strongly supported by the Report of the Select Committee, which says:—

"Your Committee, therefore, while on the question of principle "they see no objection to the imposition of a duty to countervail a "bounty, and on the practicability of levying it no insurmountable "difficulties, feel themselves precluded from recommending its "adoption in face of the statement made by Mr. Kennedy. At the "same time they would recommend that Her Majesty's Government "should institute careful inquiry into the matter, as in the event of "its being found impossible to arrive at an international agreement "for the suppression of bounties without Her Majesty's Government "assenting to the insertion of a penal clause similar to Clause 19 of "the Convention of 1864, your Committee would have been prepared "to recommend the adoption of such a course had it been practicable "under our existing treaties, and they are of opinion that in any "renewal of those treaties the opportunity should be taken of making "such alterations as would leave Her Majesty's Government at "liberty to deal with the question."

I ought to mention in reference to this matter that in July, 1879, the legal opinion of Professor Sheldon Amos and Mr. Wallwyn Poyer B. Shepheard, of Lincoln's Inn, on this point was handed in, which went very fully into the question, and concluded as follows:—

"Therefore we are of opinion that imports of sugar into this country "may, without contravening the favoured-nation-clauses of existing "commercial treaties, be distinguished as to countries of origin "wherein bounties on export are or are not obtainable, and a "countervailing duty levied on sugar imported from countries where

"export bounties are obtainable, whilst sugar from other countries is "admitted duty free."

I may also remind your Lordship that in the Convention of 1888 the difficulty was avoided by substituting prohibition for a countervailing duty.

I am, my Lord,

Your obedient servant,

(Signed) EDWIN TATE,

Chairman, British Sugar Refiners' Committee.

21, Mincing Lane, London.

COUNTERVAILING DUTIES AND CANE SUGAR.

(*See preceding number.*)

The following further letter on the subject has been addressed to the Editor of *The Deutsche Zuckerindustrie* by Sir Nevile Lubbock. Up to now Dr. Hager has not thought fit to notice this communication.

Permit me to thank you for your courteous treatment of my letter on this subject in your issue No. 48 of last year. I regret, however, to see that we are still so far divergent in our views as to what has been the effect of the countervailing duties in America on the price of cane sugar as compared with that of beet sugar. From New York market reports I have taken out the price of beet and cane sugar c. and f. New York. as quoted week by week for the years 1896 and 1898 (down to 16th December) as stated below. The figures for 1897 I will refer to directly.

Price per cwt. of 88% beet and 96% cane sugars, c. and f. New York.

1896.	Beet, 88%.		Cane, 96%.		Difference in favour of Cane.	
	s.	d.	s.	d.	s.	d.
1st 6 months	12	2	13	6¾	1	4¾
2nd ,,	9	8	10	11¼	1	3¼
Average	10	11	12	3	1	4
1898.						
1st 6 months	9	8	11	6¼	1	10¼
2nd ,,	9	11	12	1½	2	2½
Average	9	9½	11	9¾	2	0¼

Now as to 1897. In that year the relative positions of beet and cane in the U.S. were much affected by the new legislation, as well before as after it came into force. This I will proceed to show.

Firstly, as to imports. Comparing the imports during the first six months of 1896 with those of the first six months of 1897, we get the following figures:—

	1896. Tons.		1897. Tons.	
Imports of Beets 1st 6 months	292,985	..	606,735	Increase over 100 per cent.
,, Cane ,, ...	664,367	..	657,067	Decrease about 1 ,,

The threat of legislation caused an increased import of beet of over 100 per cent. Cane was scarcely affected. The following are the figures of the imports during the second six months of these years:—

	1896. Tons.		1897. Tons.	
Beet	226,032	..	30,507	Decrease 87 per cent.
Cane	413,263	..	293,933	,, 29 ,,

The legislation, when actually in force was disastrous to the import of beet. For a time it almost ceased.

Note.—The stocks in all hands (4 ports) in the U.S.A. were:—

	1896.		1897.	
Stocks on 30th June..	228,178	..	664,999	Increase 191 per cent.

Now as to price. With large stocks on hand, with increased duty on the import of both cane and beet; with an additional duty on the import of beet in the form of a differential tax (having for its effect the almost complete cessation of beet imports),—the relative prices of beet and cane sugar were singularly affected after the coming into force of the new legislation. In order to show this, I append a statement of their relative prices, c. and f. New York in monthly averages during the whole year 1897, compiled from American sources:—

1897.	Beet, 88% c. and f. s. d.		Cane, 96% c. and f. s. d.		Difference. s. d.
January	9 7½	....	10 6	....	0 10½
February....	9 4¾	....	10 8	....	1 3¼
March	9 3¾	....	10 11	....	1 7¼
April	9 1½	....	11 0	....	1 10½
May	9 2½	....	11 2½	....	2 0
June	9 0¼	....	11 6¾	....	2 6½
July	8 8	....	12 1	....	3 5*
August	9 0¼	....	9 7½	....	0 7¼
September ..	9 2½	....	10 0½	....	0 10
October	8 11¼	....	9 11¾	....	1 0½
November ..	9 1¾	....	10 0½	....	0 10¾
December ..	9 7¼	....	11 1	....	1 5¾

* New Duties, 24th July, 1897.

Of course, many reasons might be alleged for these violent fluctuations, but they must have been the result, directly or indirectly, of the new legislation, and it was not until the excess of "Stocks," consisting largely of beet, had nearly disappeared, and the refiners were compelled to buy, *i.e.*, import beet, because the available supply of cane sugar was getting low, that the full effect of the countervailing duty could be seen.

Hence, if we compare the 12 weeks of 1896 and 1898, viz., 30th September, 1st October, to 16th/17th December (I have not yet received the figures for 23rd/30th December, 1898) respectively, we find prices as follows:—

	Beet, 88% c. and f.			Cane, 96% c. and f.			Difference.	
	s.	d.		s.	d.		s.	d.
12 weeks to 17th December, 1896..	9	6	..	10	$9\frac{1}{2}$	..	1	$3\frac{1}{2}$
12 weeks to 16th December, 1898..	10	$1\frac{1}{2}$	..	12	$4\frac{1}{2}$	..	2	3

Showing a gain for the 1898 period in the value of cane of .. 0 $11\frac{1}{2}$ or nearly 1s. per cwt. resulting from the countervailing duty.

You very rightly make a point (No. 48, col. 1717,) of the necessity of comparing the price of cane and beet in the United States at a time when both are being dealt in. For this purpose the following figures are extracted from the weekly market reports of Messrs. Czarnikow, MacDougall and Co., of New York, as current quotations. That business was being done in both cane and beet at the time will appear below:—

November 18th, 1898. In New York.

96% Centrifugals, c. and f., $2\frac{3}{4}$ c. to $2\frac{13}{16}$ c. per lb.

88% Beet ,, 10/3 to 10/$4\frac{1}{2}$ per cwt.

November 25th.

96% Centrifugals, c. and f., $2\frac{13}{16}$ c. to $2\frac{7}{8}$ c. per lb.

88% Beet ,, 10/3 to 10/$4\frac{1}{2}$ per cwt.

Note.—At the exchange for $4·80 for £1 sterling.

per lb.		per cwt.	
c.		s.	d.
$2\frac{3}{4}$	=	12	10
$2\frac{13}{16}$	=	13	$1\frac{1}{2}$
$2\frac{7}{8}$	=	13	5

The above prices of cane and beet, therefore, compare thus:—

		s.	d.		s.	d.
November 18th 96% Centrifugals	.. ..	12	10	to	13	$1\frac{1}{2}$
,, 25th 96% ,,	.. ....	13	$1\frac{1}{2}$	to	13	5
Average	.. ..	12	$11\frac{3}{4}$	to	13	$3\frac{1}{4}$

	s. d.		s. d.
November 18th 88% Beet	10 3	to	10 $4\frac{1}{2}$
,, 25th 88% ,, ...	10 3	to	10 $4\frac{1}{2}$
Average..	10 3	to	10 $4\frac{1}{2}$
Compare cane as above	12 $11\frac{3}{4}$	to	13 $3\frac{1}{4}$

				Average. s. d.
Difference in favour of cane over beet	2 $8\frac{3}{4}$	to	2 $10\frac{3}{4}$	2 $9\frac{1}{4}$
Average difference during 12 months 1896				1 4
Gain to cane from countervailing duty				1 $5\frac{1}{4}$

With reference to the cane and beet prices of November 18th and 25th, 1898, just quoted, Messrs. Czarnikow, McDougall & Co.'s market reports state:—

1898, November 18th. "There has been active buying of cane sugars and we have thus again seen the absorption of nearly all the cane sugars available for forward shipment from distant countries. Under these circumstances our refiners turned their attention to European markets and within the last few days bought, it is believed, 25,000 to 30,000 tons of beet. As might be expected, no sooner had they entered European markets than prices there advanced, and it became difficult to secure new beet for prompt shipment even at 10/3 c. and f. which is equal to 4·35c. for duty paid centrifugals." 1898, November 18th. "The purchases of beet had already started last week, and as refiners continued buying prices advanced, so much so that on the 21st inst. quotations reached 10/3 f. o. b. for this and next month's delivery. It is estimated that at least 80,000 tons were so placed. Foreseeing that it would be bad policy to keep on buying beet, the American refiners retired from European markets, with the result that prices slackened a little."

Cane and beet sugars were therefore in full competition with each other at the period above mentioned.

Now as to Java sugar. I quite agree with you that if West India sugar is a gainer in price as compared with beet from the operation of the countervailing duty so ought Java sugar to be a gainer. As to this let me again quote from Czarnikow, MacDougall & Co.'s market report.

1898, September 16th. "Owing to the countervailing duty on beet sugars, the Java planters obtained this year prices nearly one shilling higher than those they obtained last year, and although beets have ruled at about the same figures in both years, the premium on cane sugars has become sufficient to induce the planters to sell, hence the fact that such a large portion of the Java crops has already been marketed. . . . . . Beet sugars have been offered here this week in fairly large quantities at 9s. $10\frac{1}{2}$d. c. and f., but no business has been reported."

From the same circular I take the following quotations for beet and cane sugars:—

		s. d
Beet, 88% c. and f., New York..	per cwt.	9 $10\frac{1}{2}$
Cane, 96% ,, ,, ,, $2\frac{11}{16}$ c. per lb.	equal to	12 $6\frac{1}{2}$
Difference in favour of cane		2 8

Comparing the difference in favour of cane for the year 1896 (1·4), we get the gain to cane from the countervailing duty, viz., 1s. 4d.

The same circular states that cane was being bought at the price stated ($2\frac{11}{16}$ c. per lb. c. and f.), but that large offerings of beet at the price stated (9s. 10½d. per cwt. c. and f.) were refused.

You ask, if my contention is right, how is it that so much cane sugar still goes to the United Kingdom? I reply, that without attempting to estimate what quantity of cane sugar will continue to come to England in the future, it is probable that:—

1. The large confectionery trade of the United Kingdom will always demand and pay the price for some cane sugar.

2. The brewing and other industries also require, and will continue to obtain, considerable quantities of low cane sugars.

3. A quantity of West India sugar, yellow grocery, for which there is a constant demand, will continue to come to the United Kingdom, and such sugar has recently been fetching prices of 15s. to 17s. per cwt., as compared with 11s. 6d. for German granulated.

4. In 1898, no doubt a lot of Phillipine sugars came here in consequence of the war.

5. We have probably not yet seen the full current of diversion to the United States of cane sugar caused by the countervailing duty.

Finally,—I have taken the opportunity to enquire in what way American refiners estimate the influence of the countervailing duty upon the prices which they are willing to pay for beet and cane respectively when they want raw material, and I find they always treat the countervailing duty as a charge against beet sugar, just in the same way that they treat landing-charges, lighterage, or any other outlay, viz., as a charge to be added to the c. and f. price paid for beet sugar.

I am, Sir,

Yours faithfully,

(Signed) N. Lubbock.

20, Eastcheap,

London, January 4th, 1899.

ON THE COMPOSITION OF CERTAIN RAW SUGARS AND PRODUCTS OF REFINING.

By Dr. Edmund O. von Lippmann.*

The composition of various products of the manufacture of sugar, especially with regard to the proportion between ash and organic constituents has, of late, repeatedly formed the object of research, which however, with isolated exceptions, has only extended to sugars, masse-cuites, &c., met with in beet sugar manufacture. It will, therefore, not be without interest to become acquainted with figures of this kind relating also to the working processes of refining, the results of which as a rule command only slight attention on the part of the manufacturers of raw sugar, although they give rise to very many remarkable conclusions not unimportant in connection with the production of raw sugar. For this reason I give below figures ascertained by continuous analysis, and calculated, according to the geometrical average, from the working of a refinery which during eight campaigns has, on the whole, practised throughout a method of working identical in its main principles.

Raw sugar.

Washed sugar. Washed syrup (Green syrup)

Refined masse-cuite.

Refined sugar. Green syrup.

Second masse-cuite.

Second (refined) sugar. Green syrup.

Third (refined) sugar masse-cuite.

White after-product. Green syrup.
(ev. Raw sugar, second jet).

Raw sugar masse-cuite (third jet).

Raw sugar (third jet). Green syrup.

After-product masse-cuite (fourth jet).

After-product. Molasses.

*Translated from a reprint from the *Deutsche Zuckerindustrie*.

The washing of the raw sugar was effected by means of water-spray, without the addition of better syrups, so that the raw sugar was entirely separated into green syrup and washed sugar, the further working up of which can easily be seen from the table. The white sugar masse-cuite yielded white after-product (eventually also raw sugar of the second jet) or was, in case the market was against the former, only centrifugalled to raw sugar (so-called second jet), its green syrup combined with the fining syrup to form the raw sugar masse-cuite, which in its turn yielded raw sugar (so-called third jet) and a syrup, which being again boiled down yielded according to its quality very varying quantities of after-products as well as molasses. The after product was sometimes sold when the market was favourable, but mostly served as an addition to the raw sugar masse-cuite. The raw sugar third jet, as well as the raw sugar second jet, were reintroduced into the working in the process of refining. The washing clairce is not taken into consideration in the above table, so as not to complicate it unnecessarily, and I will only remark that the fine syrup succeeding the green syrup (that is the runnings during the washing) always returned into the respective original product, as for example the fine syrup from the refined into the clairce for the refined and with this into the refined masse-cuite. The purity of the refined sugar and the refined masse-cuite amounted, to quote as an example the average figures of a single year, to 99·7; that of the masse-cuite was then 97·8; of the white sugar masse-cuite 93·8; of the raw sugar masse-cuite 81·5; of the after product masse-cuite 65·3; of the molasses 57·3. The analysis of the sugar, for example, was 98·49 dry substance, 98·30 polarization, 1·51 water, 0·09 ash, 0·10 organic matters 99·3 purity; proportion of ash to organic matters, therefore, = 1 : 1, 11. This ratio of ash to organic matters, being the proper characteristic, is given in the following table for the eight campaigns in question, and it affords a much clearer view than could be obtained from the whole of the individual analyses.

It is hardly necessary to specially mention that these figures, from the nature of the case, indicate only general results, not however agreeing in detail mathematically and correctly with each other, the difficulties connected with taking samples being, even with the greatest care, absolutely insurmountable, especially with impure products, and the more trouble we take with them the more thoroughly do we become convinced of this, and it may therefore be considered very satisfactory if, for instance, associated syrups and masse-cnites yield in the long run results only approximately agreeing with each other.

Year.	Raw Sugar.	Refined Masse-cuite.	Washed Syrup.	Green Syrup from Refined.	2nd Masse-cuite.	Green Syrup.	3rd (Refined) Masse cuite.	2nd Jet Sugar.	Green Syrup.	3rd Jet Masse-cuite.	3rd Jet Sugar.	4th Jet Masse-cuite.	4th Jet Sugar.	Molasses.
1	1·84	1·11	1·87	1·35	1·43	1·52	1·56	..	1·78	1·88	1·88	1·88	1·17	1·97
2	1·97	1·42	2·15	1·49	1·51	1·68	1·69	..	1·88	2·08	2·08	1·98	1·26	2·19
3	2·33	2·42	1·97	2·38	2·36	2·56	2·69	..	2·89	2·35	2·23	2·38	1·47	2·49
4	2·06	2·25	2·00	2·31	2·36	2·45	2·47	..	2·52	2·21	2 13	2·19	1·41	2·29
5	2·02	2·00	1·98	2·01	2·00	2·12	2·07	..	2·12	2·09	2·01	2·17	1·22	2·33
6	1·64	1·77	1·68	1·76	1·82	1·84	1·86	1·26	2·00	1·74	1·76	1·74	0·94	1·84
7	1·31	2·02	1·26	2·06	2·08	2·10	2·12	1·09	2·27	1·60	1·35	1·78	0·95	1·89
8	1·25	1·90	1·21	1·93	1·88	1·98	2·16	1·09	2·25	1·52	1·35	1·76	1 28	1·85

Secondly, the unavoidable analytical errors have to be considered, as the organic substances, as is well known, can only be ascertained by differentiation, and the uncertainty of their determination is largely increased as soon as adverse conditions arise, such for instance as the presence of much raffinose, which compels the application of the raffinose formula, further, the presence of abnormal quantities of organic substances which undergo and cause decomposition, giving rise to the formation of volatile products which increase the so-called total loss (carbonic acid, acetone, furfurol, &c.), in many years have caused the remarkable phenomenon, already formerly described by me and confirmed by Dr. Drenckmann, that the true quotients turn out lower than the apparent ones. From column I. of the above table it will be seen that with the raw sugar the proportion (V.) between the ash and organic matters begins with 1·84, increasing within two years to the abnormal height of 2·30, and decreasing gradually again to 1·25; of course it must not be deduced from this that the absolute quantity of non-sugar has also diminished, but odly that the proportions between ash and organic matters have undergone a change.

By the process of washing (Column 2) V., changed in nearly all cases, and although the washed sugar had always a purity of 99·6 to 99·8, it fluctuates within the wide limits of 1·11 and 2·42. In the years I. and II., the washing perceptibly improved the V., in the III. and IV. this was no longer the case, this means that the organic matters were more difficult to remove than the ash, a prolongation of the period of washing not effecting a change; manifestly we are dealing with organic matters which are either not in combination at all with the ash or are at least not removed in the proportion that has to be usually presumed in making the ordinary calculation of the rendement, if there was any sense at all in making such a calculation.

(To be continued.)

UNITED STATES.

Countervailing Duties on Bounty-fed Sugars.

(From Willett & Gray's Statistical, Dec. 22, 1898.)

The following revised rates went into effect on the 12th inst. Russian sugar has been exempt from additional duties heretofore, but will now be assessed countervailing duties as stated. The most important changes are a reduction on sugar from Austria and an increase on Holland (the Netherlands) sugar. Rate on German sugar remains unchanged. Under the heads of France and of the Netherlands provision is made for ascertaining the rate on refined sugar manufactured from raws produced in another country.

Circular No. 199.

Treasury Department, December 12, 1898.

To Officers of the Customs and Others Concerned:

Section 5 of the act of July 24, 1897, provides as follows:

(See Weekly Statistical, July 22, 1897, for copy of Sec. 5, providing for countervailing duties equivalent to bounties.)

In pursuance of these provisions, the following amounts of bounties respectively paid, or bestowed directly or indirectly on the export of sugars by the countries hereinafter named, are hereby declared for the assessment of additional duties on sugars imported from, or the product of, such countries or their dependencies, viz.:

ARGENTINE REPUBLIC.

(1 centavo, ·965c. 1 kilo., 2·2046 lbs.)

On sugars produced in the country since January 20, 1897, and exported with benefit of drawback, 6 centavos per kilogram. (2·63c. per lb.)

AUSTRIA-HUNGARY.

(1 florin, 40·6c. 100 kilos., 220·46 lbs.)

1. On sugar under 93 per cent. and at least 88 per cent. polarization, 1·37 florins per 100 kilograms. (·252c. per lb.)

2. On sugar under 99½ per cent. and at least 93 per cent. polarization, 1·46 florins per 100 kilograms. (·268c. per lb.)

3. On sugar at least 99½ per cent polarization, 2·10 florins per 100 kilograms. (·386c. per lb.)

DENMARK.

(1 crown, 26·8c.)

On refined sugar produced wholly from beets grown in Denmark, 1·12 crown per 100 kilograms. (·136c. per lb.)

FRANCE.

(1 franc, 19·3c.)

Raw sugars of the standard of 65 to 98 per cent. for beetroot sugars, or of 65 to 97 per cent. for French colonial sugar, per 100 kilograms of refined sugar, 100 per cent., francs 10·82. Sugar candies calculated at their legal equivalent, per 100 kilograms, effective weight, francs 11·51.

Refined sugars in loaf or crushed, clear, hard and dry, per 100 kilograms, effective weight, francs 11·51. (1·007c. per lb.)

Raw and refined sugars in grains or crystals, of a minimum standard of 98 per cent., francs 11·17c. (·978c. per lb.)

The output of refined sugar from raw is calculated by deducting from the polarization of the raw sugar twice the glucose, four times the ashes, and 1½ per cent. for loss in refining.

GERMANY.

(1 mark, 23·81c.)

1. On raw sugar at least 90 per cent. polarization and on refined sugar under 98 per cent. and at least 90 per cent., 2·50 marks per 100 kilograms. (·270c. per lb.)

2. On candy and sugar in white, hard loaves, blocks, crystals, &c., at least 99½ per cent., 3·55 marks per 100 kilograms, (·383c. per lb.)

3. On all other sugar at least 98 per cent., 3 marks per 100 kilograms. (·324c. per lb.)

THE NETHERLANDS.

(1 florin, 40·2c.)

On raw sugar produced in the country from beets and testing less than 98 per cent., 2·2354 florins per 100 kilograms of hard refined (100 per cent.). (·408c. per lb.)

On raw beet sugars testing 96 per cent. or above, three-fourths of said bounty, viz., 1·7655 florins per 100 kilograms of hard refined. (·322c. per lb.)

On refined beetroot sugars, ·2946 florins per 100 kilograms of hard refined (100 per cent.) *in addition to the above bounties.* (·0537c. per lb.)

On refined sugar from other materials than beet raw sugar produced in the country, ·2946 florins per 100 kilograms of hard refined. (·0537c. per lb.)

The output of refined sugar from raw is computed by deducting from the polarization of the raw sugar twice the glucose, four times the ashes, and 1½ per cent. for loss in refining.

(20473.)

Treasury Department, January 3, 1899.

I have to inform you that the provisions of Department Circular No. 199, of December 12, 1898, relative to sugar bounties, are applicable only to sugars shipped to the United States on or after that date, previous shipments remaining subject to the provisions of similar circulars in force at the time of such shipments.

Of the two classes of raw sugar produced in Holland, specified in said Circular No. 199, the class receiving the lowest bounty (equal ·322c. per lb., W. & G.), viz., sugars testing 98 per cent. or above, is not at present produced in any considerable quantity, and, so far as the department is informed, is not used in refining. Should the importers of any sugar from Holland claim that it was refined from

raw sugar testing 98 per cent. or above, such claim will be scrutinised with the utmost care, in view of the strong presumption to the contrary created by the existing conditions of the sugar industry in that country.

RUSSIA.

(1 rouble, 51·5c.)

On sugar testing not less than 99 per cent. per pood (36·113 pounds avoirdupois), ·50 rouble. (·727c. per lb.)

On sugar testing not less than 88 per cent. per pood, ·44 rouble. (·627c. per lb.)

On sugar testing not less than 75 per cent. per pood, ·38 rouble. (·542c. per lb.)

Every invoice of sugar must be accompanied by a certificate of the United States Consular Officer at the port of shipment to the United States, naming place and country where the merchandise was produced, and, in a case of refined sugar, naming also the country of production of the raw sugar, molasses, or syrup used in the refining.

The liquidation of entries of sugar not accompanied by such certificate shall be suspended, and the estimated duties shall include an amount sufficient to cover the additional duty to which such sugar may be apparently liable.

The conversion of the several foreign currencies mentioned above into United States money will be governed by the provisions of section 25 of the Act of August 29, 1894.

The question as to the net amounts of the bounties indirectly bestowed by the Goverment of Belgium on exported sugars is under consideration. Pending the ascertainment and determination of said amounts, entries of sugars imported from, or the product of, that country will be subject to the provisions of Circular No. 174, of October 19, 1897 (synopsis 18481).

(Signed) L. J. GAGE, Secretary.

(18481.)

Sugars imported from or the production of BELGIUM.

(Circular No. 174.)

Treasury Department, October 19, 1897.

To Collectors and other Officers of the Customs:

In view of the information thus far received as to the operation of the law of Belgium now in force, concerning the excise on sugar, it

appears highly probably that sugars exported from that country receive export bounties as follows:—

On raw sugar, 4·50 francs per 100 kilogrammes; on refined sugar, 5·36 francs per 100 kilogrammes.

Pending further investigation of the matter, the liquidation of all entries of sugars imported from or produced in Belgium shall be suspended, and the duties shall be estimated in amounts sufficient to cover additional duties equal to the above specified bounties.

GRANULATION OF LOW PRODUCTS IN SIXTY HOURS.

By Geo. Stade.

Since the introduction of the diffusion and maceration processes, the abolition of the use of char in factories and refineries, and the establishment of multiple evaporation, no processes have been of more importance for the beet and cane sugar industries generally than the new systems of boiling to coarse grain the runnings from the first sugars, &c.

It is evident that the simplicity and the great advantages of these processes in doing away with all reservoirs, crystallisation tanks, masse-cuite pumps, gutters, and pipes, as well as the extensive buildings for storing, during from two to six months, the second and third masse-cuites, is leading to the adoption of these systems in the near future by all modern works. Besides, nothing can be cleaner than the working off of the low products in the same manner as the first sugar.

There are different ways of obtaining—without storage tanks—all the sugar in the masse-cuites, as far as that is possible by means of crystallization:—

I. The Hugh-Vacuum Malaxeur gives (in cane sugar factories), if proper time is allowed for exhausting the syrup, first sugar (in a raw state) and refuse molasses. However, this system cannot be used if sugar of a special quality, for direct consumption, such as white sugar, Demerara crystals, etc., is required.

II. The Bock Apparatus give, if properly managed, good grain and, supposing the crystallization in movement is continued long enough, yield also exhausted refuse molasses. With this system the syrups are boiled in a vacuum and then transferred to the continuously

working closed malaxeurs. The time for finishing, however, is considerable compared with other systems—consequently many malaxeurs are necessary to eventually work off all the syrup-molasses.

III. Some Systems boil down the syrups in the ordinary vacuum-pan and transfer the masse-cuite afterwards into open malaxeurs (with or without continuous action) for granulation. Four to five days at least are required for finishing.

IV. The Grosse Process (last, not least) granulates the syrup-molasses in a specially constructed vacuum-pan and simply finishes—*in the very same pan*—down to exhaustion of the refuse-molasses *in 60 hours*. As a rule only three pans are required to deal with the entire quantity of the syrup-molasses in a factory.

There is now no further uncertainty about the success of these operations, since it has been practically *proved by over seventy new pans working this season without reservoirs* and yielding, with the Grossé process (after sixtyhours' boiling), a far superior sugar to the old seconds and thirds. It may now be considered as certain that any quality of normal crystallisable molasses can be grained directly in the Grossé vacuums without difficulty. After less than three days all sugars are ready for bagging, and the refuse molasses can then go at once to the distillery or "sucraterie," &c. This, of course, means cash at once for these products, and saves interest, expenses, and labour. As soon as the season is over, the mechanics can go ahead with the repairs; there are no more boilers to be fired, no more centrifugals and engines to be attended to.

For the refineries, on the other hand, it means also a considerable simplification of the whole system, only a few products being necessary, while in former days six to seven were quite usual.*

The sugar itself (a sample *taken from the heap* by the writer himself is deposited at the office of this journal) is generally admitted "to be as good as anything that could be desired or hoped for from syrup molasses." For beet factories, the remaining molasses sometimes show apparent purities of under 56 %; this means they are far better worked out than with the tank storage system. In the case of cane factories the enormous loss by inversion is also saved,† and the molasses can be worked out under 35 % purity.

* *Vide* G. Stade, "On the Working of a Sugar Refinery," *The Sugar Cane*, 1885, page 13.

† *Vide* E. Riffard, "Inversion and Loss in Cane Sugar Manufacture," *The Sugar Cane*, 1893, page 343.

The following figures are given by one of the leading factories which has adopted the Grossé system. They are communicated by the proprietors officially, as representing the work done with three Grossé vacuums, during this season, 1898-1899:—

Saccharose in Beets .. .. = 14·71 % on beets.

I. Product obtained .... = 12·16 % ,, (of 95·58 % polarization).
Coarse-grained low products = 1·44 % ,, (of 90·50 % ,,).*

Total sugars .. .. = 13·60 % ,,
Molasses .. .. = 1·85 % ,, (of 47·40 % ,,).

Practical extraction per 100 tons saccharose in beets .. .. .. = 92·4 tons in commercial sugars

Chemical extraction per 100 tons saccharose in beets .. .. .. = 87·9 tons saccharose ,, ,,

Losses on saccharose (I.) % beets (1) in manufacture = 0·91 % of beets.
(2) in molasses .. = 0·88 % ,,

Total saccharose not extracted = 1·79 % ,,

(II.) % saccharose in beets:—
(1) in manufacture .. = 6·2 % of the saccharose in the beets.
(2) in molasses .... = 5·9 % ,, ,, ,, ,,

Total saccharose not extracted = 12·1 % ,, ,, ,, ,,

100 tons total commercial sugar = 10·6 tons low products.
100 tons I. sugar .. .. .. = 11·8 tons low products.

The total arrangements, complete for working say 500 to 600 tons canes or beets in 24 hours, cost about £2,200, in Europe, including patent-royalties. There were no tanks used at all. Many new factories, which are in course of construction, have now adopted the Grossé process also, and are consequently fitted up without masse-cuite storage. Samples and further information can be obtained through the agency of the writer.

* This sugar, washed white, was of such a quality that it was used straight off for refining, without passing over charcoal.

EGYPT.

(*Concluded from page 102.*)

The commencement of any rational cultivation must, above all, be made by a judicious selection of the material for planting. Frequently the canes rejected for manufacturing are used for the new planting. This is naturally false economy. Only the best canes, rich in sugar, and which have not been stored, ought to be used for planting.

The different parts of the cane stem are likewise not of equal value for planting. By experiments made here it was proved that the upper part of the cane stem used as plant-cane, as compared with the middle portion, yielded without manuring an extra quantity of about 3,500 kilos. per hectare,* and as compared with the lower portion, about 17,500 kilos.† The upper portion part ought therefore to be preferred as cuttings for planting.

By throwing out this portion the factory would obtain material richer in sugar. Should obstacles, such as want of workmen, &c., stand in the way of the planting being done at the time of harvest, special fields ought to be cultivated with cane, from which six to eight months old cane can be obtained for planting. Cane of this age possesses, in the entire stem and in the composition of the juice, the same efficiency and vitality for the development of a vigorous fresh plant as the upper portion of the ripe cane. The planting itself is carried out as follows :—

The cuttings are deposited in the furrows, and the latter are then filled with water and the cuttings trodden down into the soil. This is the method in general use among the Fellaheen. A somewhat better way of planting is that of setting the cuttings in the trenches with a hoe, the latter being then filled with water. A third way is to plant some days after a slight irrigation of the soil. This last method is the best, as it admits of the cuttings being placed in the most suitable position, about 1½ inches below the surface. The first-mentioned clumsy way is, however, the most used. It is further not advisable to plant too closely.

The Arab plants at distances of about 0·70 m. (¾ yard), and believes he obtains more cane by so doing. All plants require more sun, light and air in the tropics than in the north, especially for the formation

* 1 ton 7 cwt. per acre. † 6 tons 15 cwt. per acre.

of sugar. A field so closely planted is, however, completely dark in the interior of the rows. I cannot as yet state with certainity what is the most suitable and profitable distance for planting in this soil and climate and with the native variety of cane. The distance probably lies between 0·90 and 1·20 m. (35½ to 47 inches) The cultivation of the soil also leaves much to be desired. Many large estates are already being cultivated by means of the steam plough. The lumps of earth which, on drying after the inundation of the Nile, become as hard as stone, and cannot be pulverized by a single ploughing, are a serious drawback. The whole country is covered with such hard lumps as large as a man's head. A simple mechanical process of disintegration could be easily carried out. The heavy alluvial soil of the Nile requires more ventilation by means of ploughing than any other land. After the ploughing the land must be hoed at the right time to remove the weeds, and to loosen and expose the soil to the air. This operation is repeated here three times, and ought to be finished when the leaves begin to shade the ground.

After the last hoeing, the next proceeding is to heap up the earth against the cane as far as the stems are free. The treatment of the soil for the cultivation of the cane is then finished. The irrigation has now to follow at intervals of from ten to fourteen days. At the time of planting the requisite preparations are already made by levelling and practical laying out of water trenches, so that only the entrance to the nearest canal needs to be opened to distribute the necessary water through the individual divisions. The cane needs a tolerably large quantity of water in the dry districts of Upper Egypt, which is also practically destitute of roads.

At the end, in the period of the rapid formation of sugar—about one to two months before the harvest—according to the weather, no more water should be supplied, so as to give the cane rest for the formation of sugar.

All these factors combined result in the production of the normal cane. Above all, the proper cultivation of the soil has to be considered so as to give it the good physical composition necessary for the development of the plant, and secondly a judicious selection of the planting material. What can be further achieved by artificial manuring has yet to be shown. As sun and water are to be had *ad libitum* it should be possible to make a garden out of every field. The land in this neighbourhood is let out for the cultivation of cane for two years at twenty pounds sterling per feddan, thirteen pounds

of which are paid in the first year and seven pounds in the second year. The payments take place at the time of harvest. The land is handed over to the farmer ready for sowing.

The expenses per feddan for the planting, &c., up to and including cutting are as follows:—

For the First Year.

	Piastres.
80 Cantars Cane Cuttings at $2\frac{3}{4}$ Piastres	220
Planting	50
Hoeing and Earthing Up	42
Overseer	13
Watering	50
Watchman	10
Harvesting	100
Total	485

For the Second Year.

	Piastres.
Watering	50
Hoeing and Earthing Up	42
Watchman	10
Manure	100
Total	202

The rent above mentioned has to be added to these amounts.

The yield per feddan for the whole of Egypt is estimated, for one and two year old cane together, at an average of about 500 cantars per annum.

The first year cane (called *garss*) yields 550 to 570 cantars per feddan.

The second year cane (called *shilfe*) yields 200 to 400 cantars per feddan.

The rotation of crops in this neighbourhood is as follows:—

First year: Cane (garss).

Second year: Cane (shilfe).

Third year: Berzim *(trifoline alexandrinum)*, durrah, maize, beans, &c.

Fourth year: Allowed to lie fallow under the Nile water.

Fifth year: Cane, and so on.

If this rotation has been carried out several times successively, the soil gets so far exhausted that only first year cane can be grown with

profit, and a change has to be made again with cotton or some other cultivation. The whole surface under cane cultivation in Egypt may be estimated at 62,000 feddans, 40,000 of which belong to the Daira Sanieh (Government administration), 15,000 to large private estates, and 5,000 are planted by the fellaheen. The further increase of cane cultivation depends upon the future extension of irrigation works, and of the system of canals on the banks of the Nile.

Some time ago the estate of the Daira Sanieh, nine sugar factories with the land belonging to them (some 125,000 feddans), was purchased by a European company for the sum of six and a half million pounds sterling, which may become a very important factor in the future of the sugar industry in Egypt. These Government works, which formerly under the native management paid little or no interest, will no doubt be converted after re-organisation into well paying concerns, as is reasonably to be expected in a country so favourably situated for the sugar industry.

The Daira factories all work with the mill system. The three diffusion factories of the French Société Générale de Haute Egypte, which work technically well, do not possess an acre of their own land, and have therefore to buy all their cane, and are dependent on the Arabs.

The fourth diffusion factory, Beni Korrah, belonging to the Copts, has done badly during the two first campaigns on account of imperfect technical arrangements and bad administration. Working by diffusion has in Egypt probably the best chances in the future of all cane cultivating countries, in consequence of the totally rainless climate.

The chips coming from diffusion are passed through a crushing mill and then spread out in the sun, and in a few days are so far dried that they contain 30% or less water, and they then make very good fuel. The Godillot boiler firing arrangement is excellently suited for burning cane chips and trash. In addition, molasses, which otherwise are almost valueless, are also used as a fuel. They yield 25% of the heat supplied by coal, and burn excellently when the fire is once started. They have to be properly raked when once they are alight. After combustion there remains a very good saleable potash, containing about 40% of K_2CO_3 (potassium carbonate), besides other alkalies. This crude potash is exported to Belgium and Holland to be used in the manufacture of glass. I have used the ash of the molasses this year also for some field experiments.

As every picture has its dark side, so is it also with fertile Egypt. This dark side is the Arab. Born stupid and learning nothing is a fair definition of the race. To this must be added the fanaticism of the Musssulman, and an absolute hatred of all European civilisation. While, for instance, the South American native and the mixed races living there adopt the European customs comparatively easily, the Arabs, even those who by rank and position belong to the better class, cling obstinately, in their conservative ignorance of the outside world, to old customs and methods of working. The fellah has no wants, and lives sluggishly stupid in his mud hut as his forefathers lived a thousand years ago, and uses the same primitive tools, implements, buckets for irrigation, &c. A contemptuous smile is his answer to well-meant advice, and his criticism on the introduction of reasonable methods of working. It is not easy to work with the Arab, but it requires still greater patience to compel these people to make any advance in the way of adapting their rich lands to European industrial methods.

THE DEMING SYSTEM OF CLARIFICATION.

This system, now universally recognised as the greatest advance in sugar manufacture the industry has known for a decade, is of recent development, attaining a most wonderful and rapid perfection.

The first successful Superheater was operated on Palo Alto Plantation during the season of 1894. During 1895 there were four machines placed in Louisiana and one in Mexico. During 1896 there were placed five machines in Louisiana, one in Mexico, one in Trinidad, and two in Hawaii. During 1897 there were placed in Louisiana 20, Trinidad one, Texas one, Hawaii three. During 1898 there were placed in Louisiana 11, Hawaii eight, Texas one, St. Croix one, Java, one, or a total of 62 machines in three years. Daily capacity in short tons:—1894, 600 tons; 1895, 3,500 tons; 1896, 6,500 tons; 1897, 22,200 tons; 1898, 28,400 tons, a total of 51,200 tons per 24 hours, or a daily capacity of ten million two hundred thousand gallons of juice.

Within the above period has been developed a perfect system of continuous settling tanks for removing the sediment from the juices, which form a most valuable adjunct to the principle of high and instantaneous application of heat as employed by this system, which

practically eliminates the gums and all other refractory elements that disturb the manufacture and prevent crystallisation.

By the use of this process can be obtained more and better sugar, great economy of labour, and a saving of at least one-third the steam required by the open process, with the certainty of obtaining a superior clarification of absolute uniformity.

Of the 62 machines above mentioned as placed, 18 have been used for tropical grown canes, 13 of these are in Hawaii.

In connection with this process have been developed a number of economical features especially designed for sugar houses having some waste heat, such as surplus exhaust steam or drips from steam coils, all of which may be utilised in some of the many styles of apparatus offered.

There is—First, the apparatus consisting of a Digester and Absorber properly connected by piping.

Secondly, a Supplemental Absorber through which the juices may be passed where they are heated by waste heat or direct steam, requiring to this extent less steam direct from the boilers.

Thirdly, a Supplemental Digester, differing from the supplemental absorber merely in length and diameter. These machines may be detached for cleaning.

Fourthly, what is known as a Duplicate Digester Setting, which consists of two digesters placed side by side and one absorber above, midway between them. Each digester is of a capacity equal to the sugar-house, and each has, in addition to a live steam connection, an exhaust and drip connection.

In operation the juice (after sufficient has been used to reduce the temperature of the superheated juices) enters either of the digesters, where it absorbs all waste heat, then passes to the other digester for its final tempering with live steam direct from the boilers.

The arrangement of piping on this apparatus will permit of either digester being used for waste heat, and also permit either digester to be disconnected for cleaning with acid or scraping.

This installation, in addition to its economical feature, provides the sugar-house with a duplicate apparatus, being a desirable element for safe working.

At times all sugar-houses, even the best equipped, have some surplus exhaust steam, which can be utilised in the clarification to better advantage than elsewhere.

There are seventeen sizes of apparatus now perfected, ranging in capacity from 68 tons to 3,000 tons per 24 hours; one or more of nearly all the several sizes are now in practical operation.

In justice to the process it may be said it has never been replaced by any other, although it is continually replacing others, and the large number of second orders (nine), of the third orders (three), of the fourth orders (two), and of the fifth orders (one), indicate very clearly the opinions of those who, through several seasons of experience, should be well prepared to judge of the advantages of this process.

Their faith, as shown by their actions, is the strongest possible endorsement the process has, and is of more value to the would be purchaser than whole pages of reading matter or hours spent in conversation with persons who may but imperfectly understand the process or through some cause be not qualified to discuss its merits.

This process has become a fixture for the cane sugar industry, and it is universally conceded that it must sooner or later replace all forms of open clarification, and will only be replaced by some system based upon principles underlying this process, which is quite improbable, considering the improvements made since the earliest apparatus appeared.

IMPROVEMENTS IN TROPICAL AGRICULTURE.

A Paper read by Mr. Hart, F.L.S., of Trinidad, before the Agricultural Conference at Barbados.

* * * * * * * * * *

I take it to be admitted that improvements in the quality of West Indian produce would be desirable and beneficial, and would add to the wealth and prosperity of the Islands, and therefore I must discuss the means by which these improvements can be effected.

To go through the whole list of the products of the West Indies which are capable of improvement, would take up too much time, and two or three will serve as illustrations of what is possible, for the means of improvement are similar in each case.

I place the sugar cane first on the list, because, at the present time it is probably more in need of assistance than any other kind of cultivation. Some people, as I have said before, do not believe this, and hold to the idea that the Bourbon, the Transparent, or the Old Purple are quite good enough, if only they could get the Home Government to institute "countervailing duties," or some other

panacea for their troubles. I deny that they are good enough; they stand in need of improvement, and if proper improvement were effected the position of the sugar industry would be in a very different state to what is it to-day.

Now, it is no use beating about the bush, it is better to say at once (even if we offend some of our good friends) that if sugar is ever again to prosper it must be on different lines than in the past. Some, perhaps, would reply to this: Well, if it must be done, why don't you start and do it? The answer to the question is ready. A start has already been made, and no little success has been achieved. Several have set themselves the task—I won't say the thankless task — because we are fairly well certain that thanks will come later if perseverance is duly maintained. Opposition will be met there is no doubt, little help will be afforded, and covert sneers may be given; but what of that? When the victory comes, it will be all the more complete if gained against these disadvantages. It is not to be expected that work of this kind can be done in a day, for it is really the work of years, and work that should have been begun years ago. There is no little reproach in the use of the word "should," for if the work had been begun soon enough we should not be so far from the ideal as we are to-day. Under proper direction we should have been able to offer the planter other choice besides the Bourbon and the Transparent canes, but we have not arrived at this as yet. We are in possession of canes to-day, however, that may prove to be capable of surpassing the Bourbon for all the purposes of the planter, and may, further, be capable of being cultivated with greater economy. These canes, however, are as yet not out of their trial stages, and though they promise well, it would be the height of absurdity to recommend them to the planter until they have been fully tested in all classes of climate and soils.

To enable anyone to realise the possibility of producing better canes than the older kinds, we have only to turn to the excellent illustration which is afforded by the beet sugar industry. (See *Kew Bulletin*, page 317, 1897.) We there find that, in 1896, M. Vilmorin, of Paris, wrote the Director of the Royal Gardens, Kew, a letter describing the progress of the improvement in the quality of the sugar beet, which, in short, ran as follows:—When first known the sugar beet ("Beta maritima") contained from 8 to 10% of its weight in sugar. Selection was brought to bear, and the sugar content was raised to 12 or 13 per cent.; but this improvement took some fifty years. Then more

accurate means of ascertaining the sugar value of individual roots were found, and "in a dozen years a race was established yielding 16 to 18 per cent. sugar, and this has raised beet sugar making from a bad job to a prosperous industry." Now the means used by Vilmorin and others to bring the beet to perfection as a sugar producer are a process of seminal selection and chemical examination, *i.e.*, seedlings are grown, and from these the beet sugar producers are selected year after year, after being tested for sugar by the polariscope. Individual beetroots were grown from seed, and each individual root was first tested by having a portion of its substance taken away, without destroying the life of the root, when, if found to contain a certain per cent. of sugar, it was reserved and planted for seed, only those roots being used that were found to be fine sugar producers.

In this way the result has been obtained that we see to-day, when beet sugar is able to compete with cane sugar in the markets of the world. I may add that the above was written previous to Dr. Morris's address to the Agricultural Society, Trinidad, when he stated M. Vilmorin's opinion that the sugar cane was as capable of improvement as was the beet. If the same progress had been made with the improvement of the cane as has taken place with the beet, we should to-day have in our fields canes giving over 20 per cent. of sugar, instead of some 12·14 per cent., and this extra percentage would have enabled the cane to have maintained its standing as a sugar producer. Sugar planters say that they could hold their own if they only obtained the imposition of "countervailing duties," but it appears to be a matter of great doubt whether the cane planter and manufacturer could ever successfully contend with the manufacturer of the temperate zone unless he had points of production in his favour, as production and manufacture are much more economically carried on in the temperate zone. Beet has, however, reached the highest point of production which is possible, for it is freely admitted that the beetroot cannot be made to hold more sugar, while we have for our comfort the fact that "the cane can hold a far higher percentage of sugar than has yet been extracted," and there is therefore every incentive to progression and improvement. One reason which once kept back progress in this direction was the belief that the cane did not produce fertile seeds. The history of the proof to the contrary is well-known in the West Indies, and Barbados has the credit of making the first start in the direction of improvement.

(To be continued.)

THE BOUNTY QUESTION.

Correspondence exchanged between Mr. W. Price Abell, M.I.C.E. (formerly of Demerara), and Mr. Joseph Chamberlain.

Castle Hill, Duffield,
December 10th, 1898.

Dear Sir,

After the honour of speaking to you last night, at Sandal and Walton Station, on the West Indian question, I take the liberty of enclosing a letter from a widow lady which, by a strange coincidence, arrived this morning; only the parts I have lined red will interest you. In explanation, I may mention that ——— is a sugar estate in Demerara, equipped with the most modern and efficient machinery, and would without the bounties be worth £120,000, but with bounties unchecked—as you will see—it is valueless.

After living in Demerara, and acting as consulting engineer to several estates there and in the West Indies for ten years, I can assert that *some* of the estates ruined and on the verge of ruin *through the bounties*, are some of the best arranged, equipped, and managed it is possible to devise, producing sugar cheaper and better than is at present done anywhere in Europe. Of course, as in every line of business, some estates have factories so anciently equipped and managed that they could not pay even with fair competition, but this latter remark scarcely applies to British Guiana.

Fair and free trade in their natural product—sugar, is all that is required to save the West Indies.

Respecting "Minor Industries" for the West Indies—particularly British Guiana, from personal knowledge I assert it would be as rational to rely on this for prosperity as for a coal owner to rely on getting efficient colliery machinery from the mechanics' shop of a lace factory.

Trusting and longing to see your masterly, business-like methods succeed in saving one of England's oldest and grandest group of Colonies, and it appears that nothing but counteracting the foreign bounties, either by a countervailing duty or a bounty will do this,

I remain,
Yours faithfully,
(Signed) W. Price Abell.

The Right. Hon. J. Chamberlain, M.P.,
St. Stephen's, Westminster.

Extract from the letter referred to :—

"I heard a mail or so ago that there is a likelihood of ——— being abandoned. Can you imagine this? It is impossible for me to realise such an unhappy state of affairs. If only England could do as she should for the Colonies, but *I fear it will be too late before Government take any steps in the right direction, it is nothing but talk, talk, talk, and loss of time.*"

(Mr. Chamberlain's Reply.)

Highbury, Moor Green,

Birmingham, 17th December, 1898.

Sir,

I am directed by Mr. Chamberlain to acknowledge with thanks the receipt of your letter of December 12th, and to return the enclosure.

Mr. Chamberlain has already expressed himself in public speeches upon the subject of bounties, which, in his opinion, are bad in principle. At the same time I am to inform you that they do not have the injurious effect that you suppose, and at the present time the depression or failure of any estate is certainly not due to the existence of the Bounties. On the contrary, owing to the fact that the United States give a preference to sugars which are not bounty-fed, the West Indian planters have an advantage in the United States market which they would lose if bounties were abolished, and at the present time that loss would be between 10s. and £1 per ton.

I am further to state that Mr. Chamberlain has seen the accounts of well equipped estates which are making fair profit, and he is assured that in all cases where this does not result the fault lies with the management or cultivation.

Mr. Chamberlain agrees with you that there is not the same opportunity for other industries in Demerara, and, he would add in Barbados, as there is in Jamaica; but in the former colony he looks forward to a very large increase in the gold industry.

The net result of Mr. Chamberlain's enquiries is that the condition of the West Indies is not at all hopeless, and if he is able to induce certain capitalists to take the matter up, he believes that at no distant date we shall see a very startling recovery,

Yours obediently,

(Signed) J. Wilson.

W. Price Abell, Esq.

LOUISIANA.

Mr. Bouchereau's Report for 1897-98.

We have received this well-known publication, now in its seventy-third year of issue, and before proceeding to give some of the statistical results of the grinding season of last year, we would remark on the very full and comprehensive nature of the information contained. The report is published by subscription at the price of $3, and the planter really finds in it a record of everything that can possibly affect him as a grower or manufacturer of sugar. Thus, in the volume before us, there are long and interesting descriptions and statistical tables of production, &c., of the new acquisitions of the United States, Puerto Rico, Cuba, and the Philippine Islands, also full details of sugar matters in the Hawaiian Islands, and Consular Reports from all the principal beet sugar exporting countries, so that no sugar planter, as he reads his newspaper or meditates over the situation and possibilities of the future, need be at a loss for information on any point that may strike him. On the mere face of it, the value of such a periodical report is incontestable, and the existence of this annual for such a number of years proves the estimation in which it is held, and the ability with which it is compiled.

The total amount of sugar obtained during the season 1897-98 was 310,447 long tons, of which 26,906 tons were made by the old open processes still in use on many small estates. The production of molasses was 22,241,510 gallons. The difference between the old and the modern processes is shown by the amount of molasses per 1,000 lbs. of sugar, which, in the former case, was 85 gals., in the latter 27 gals., while the amount of sugar obtained per acre was, in the former case, 2,484 lbs., in the latter, 3,817 lbs., and that of sugar per ton of cane, 108 lbs. and 166 lbs. respectively.

Total acreage of cane 190,615 acres, producing 4,384,151 short tons of cane, the average yield of cane thus being 23 short tons = about 20½ long tons, per acre.

The tendency to reduction in the number of sugar houses, by the small planters preferring to sell their cane to large factories, is still very marked, there being only 355 sugar houses in operation in 1897-98, against 395 in the previous season. Of this number were driven by steam power, 226 worked with vacuum pans, 100 with open strike pans or steam trains, and 29 with the old open kettle.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; 322, High Holborn, London; and 118, New Street, Birmingham.

ENGLISH.—Applications.

77. Alexander Classen, London. *Process for the conversion of starch and starch-like substances and of cellulose into sugar.* (Complete specification.) 2nd January, 1899.

144. R. W. Barker, London. (A communication by C. Catlett, U. S.) *Improvements in the manufacture and treatment of filtering and decolourising materials.* 3rd January, 1899.

718. C. A. Sahlstrom. *Improvements in the process for evaporating and distilling liquids.* 11th January, 1899.

855. E. Casper, London. *Improvements in drging sugar.* 13th January, 1899.

1035. C. F. Cross and J. S. Remington, London. *Improvements in the production of starch and saccharine matters.* 16th January, 1899.

1170. J. J. Royle and O. M. Row, London. *Improvements in vacuum pans.* 18th January, 1899.

1616. H. B. Barlow, Manchester. (A communication by J. Moore, Victoria.) *An improved centrifugal pump.* (Complete specification.) 24th January, 1899.

2361. A. Coumbary and R. Farkatch, London. *Improved process for refining sugar.* 2nd February, 1899.

ABRIDGMENT.

30616. John McNeil, Govan, and Julius Lewkowitsch, Manchester. *Implements in evaporating or concentrating apparatus.* 28th December, 1897. This is an improved evaporating and concentrating apparatus, comprising a closed metal vessel, the lower part of which has rotating in it a heater, heated by steam, consisting of two hollow end disks connected by an annular series of tubes, scraping rings acted on by fixed helical guides being provided for cleaning or scraping the tubes.

UNITED STATES.—Abridgments.

617080. Charles Catlett, Staunton, State of Virginia. *Revivifying bone-black.* January 3rd, 1899. The object of this invention is primarily to increase the life and the efficiency of bone-charcoal, fullers earth, clays, and other similar materials used for filtering and decolorizing purposes. This consists in charring the same, cooling

and exposing it to air, and subsequently reducing the carbon contents of the material by reheating the same in a retort closed to prevent the admission of air.

617158. THOMAS HENDERSON, Buffalo, N.Y. *Centrifugal machine.* January 3rd, 1899. This invention relates to improvements in that class of centrifugal machines employed in drying sugar and separating the molasses therefrom, &c., its object being to provide means for balancing the material within the basket, for more evenly distributing the material upon the interior of the basket, for more thoroughly separating the molasses from the sugar, and for increasing the output without increasing the centrifugal speed.

617079. CHARLES CATLETT, State of Virginia. *Bone-black substitute and method of manufacture.* 3rd January, 1899. The object of this invention is principally to provide a material which can be used as a substitute for animal charcoal for filtering and decolourising purposes. The inventor has discovered that certain natural clays contain the proper amount of carbonaceous material so disseminated as to form, when charred, the desired thin coating of carbon over the surface of the pores, and also that it is possible in those clays containing carbonaceous material in proportions insufficient to form such coating, to add more carbonaceous material in dilute solution to produce the desired effect.

618659. T. C. GOOCH, Chicago, County of Cook and State of Illinois. *Centrifugal machine.* 3rd January, 1899. This invention relates more especially to improvements on a prior patent, No. 574060, 1896. In this patent, the conveyor through which the filtered or separated material passes away from the extractor is shown and described as located at the lower discharging throat or pipe, the latter revolving freely in the conveyor-flange. This invention has for its object the provision of means by which the material which is fed into the base of the extractor is caused to be carried upwardly therein and to be discharged therefrom at a point near the top and afterwards conveyed away.

Patentees of Inventions connected with the production, manufacture, and refining of sugar will find *The International Sugar Journal* the best medium for their advertisements.

***The International Sugar Journal* has a wide circulation among planters and manufacturers in all sugar-producing countries, as well as among refiners, merchants, commission agents, and brokers, interested in the trade, at home and abroad.**

ESTIMATES OF CANE SUGAR CROPS FOR 1898-99.

I. According to De Silva & Co. (exports).
II. „ „ Willett & Gray (crops and exports).
III. According to F. O. Licht (exports and crops).
IV. „ „ *The Prager Zuckermarkt* (crops).

	I.		II.		III.		IV.	
	1898-99.	1897-98.	1898-99.	1897-98.	1898-99.	1897-98.	1898-99.	1897-98.
Cuba	300,000*	258,000*	450,000	315,000	350,000	217,401	400,000	315,000
Porto Rico	50,000	54,000	70,000	54,000	60,000	51,022	60,000	50,000
Trinidad	45,000	52,000	50,000	52,000	45,000	48,717	45,000	40,000
Barbados	50,000	55,000	47,000	52,000	45,000	46,960	55,000	62,000
Jamaica	25,000	30,000	27,000	30,000	30,000	35,000	30,000	30,000
Leeward Islands, &c...	20,000	25,000	22,000	25,000	80,000	95,000	45,000	45,000
Martinique	30,000	35,000	32,000	35,000	30,000	30,089	30,000	28,000
Guadeloupe	35,000	40,000	40,000	45,000	35,000	37,128	40,000	35,000
Demerara	100,000	100,000	98,000	98,000	100,000	107,362	90,000	91,000
Réunion	45,000	45,000	45,000	45,000	40,000	35,239	40,000	41,000
Mauritius	160,000	120,000	150,000	120,000	170,000	117,350	160,000	129,000
Java	650,000	541,000	575,000	541,581	675,000	637,141	675,000	542,000
British India ‡........	10,000	20,000	50,000	50,000	....	....	20,000	30,000
Brazil	125,000	175,000	165,000	195,000	150,000	210,000	150,000	200,000
Philippine Isles	125,000	180,000	125,000	150,000	140,000	176,184	130,000	169,000
United States	270,000	351,000	270,000	310,000	270,000†	358,150†	250,000	310,000
Peru	65,000	50,000	75,000	70,000	60,000	65,000	60,000	65,000
Egypt	70,000	51,000	105,000	85,000	120,000	80,178	100,000	95,000
Hawaiian Islands	235,000	225,000	240,000	225,000	250,000	229,414	240,000	225,000
	2,410,600	2,407,000	2,636,000	2,501,581	2,650,000	2,577,335	2,620,000	2,502,000

The above figures are given merely to admit of a comparison of the estimates of different statisticians. They do not represent the total production of cane sugar, inasmuch as some of the figures are for exports only, while those for Queensland, New South Wales, the Argentine Republic, Central America, Haiti, &c., China, Formosa, Natal, and Spain are not included. These latter would probably increase the total for the current season by at least 350,000 tons.

* Exports. † Including beet sugar.

‡ The coarse raw sugar (*gur*) produced in India for native consumption cannot even approximately be estimated.

IMPORTS AND EXPORTS OF SUGARS (UNITED KINGDOM).

To end of January, 1898 and 1899.

IMPORTS.

Raw Sugars.	Quantities.		Values.	
	1898.	1899.	1898.	1899.
	Cwts.	Cwts.	£	£
Germany	517,838	273,110	230,766	119,437
Holland	34,675	50,685	13,744	23,439
Belgium	46,753	126,785	21,651	56,617
France	297,909	72,215	149,027	37,037
Java	2,100	20,100	1,092	11,743
Philippine Islands	94,420	50,000	35,410	22,970
Cuba and Porto Rico	....	....	....	....
Peru	221,052	55,080	112,653	29,764
Brazil	61,930	2,470	28,325	1,306
Mauritius	....	540	....	216
British East Indies	11,990	13,240	4,419	5,755
British W. Indies, British Guiana, & Brit. Honduras	172,210	80,614	97,930	60,320
Other Countries	141,623	128,094	69,500	74,659
Total Raw Sugars	1,602,500	872,933	764,517	443,263
Refined Sugars.				
Germany	652,705	930,626	455,946	576,294
Holland	149,578	156,596	94,336	103,328
Belgium	23,226	14,512	15,792	9,748
France	169,888	205,750	105,481	122,725
United States	1,004	173	1,233	152
Other Countries	20,390	110	11,228	66
Total Refined Sugars	1,016,791	1,307,767	684,016	812,313
Molasses	54,345	65,635	14,327	16,641
Total Imports	2,673,636	2,246,335	1,462,860	1,272,217

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden and Norway	6,672	3,962	3,852	2,429
Denmark	13,326	10,196	6,587	5,640
Holland	10,695	6,790	5,817	3,986
Belgium	1,658	950	895	569
Portugal, Azores, &c.	8,483	7,592	4,542	4,328
Italy	4,650	2,063	2,406	1,192
Other Countries	19,201	20,238	11,142	11,686
	64,685	51,791	35,241	29,830
Foreign & Colonial Sugars.				
Refined and Candy	15,628	14,887	9,603	8,997
Unrefined	84,246	50,237	44,677	29,425
Molasses	9,483	9,818	2,872	2,983
Total Exports	174,042	126,733	92,393	71,235

WEEKLY STATEMENT OF COMPARATIVE

For the Fifty-two weeks

	German Beetroot 88 o/o Prompt, free on board.						French Crystals. No. 3. c. f. i.			West India. Good Brown.			Java afloat. No. 15 and 16.		
	1898.		1897.		1896.		1898.	1897.	1896.	1898.	1897.	1896.	1898.	1897.	1896.
Jan. 7..	9/6	9/3¾	9/2¼	9/3	10/9		11/6	11/0¾	12/9	—	9/9	9/9	11/3	11/6	12/10½
14..	9/5¼	9/3	9/4½		10/9	11/-	11/6	11/-	13/-	—	9/6	10/-	11/3	11/6	12/10½
21..	9/2½	9/1½	9/3	9/2¼	11/3	11/6	11/6	11/-	13/6	—	9/6	10/3	11/-	11/4½	13/3
28..	9/0½	9/1¼	9/2¼		11/8¼	11/9	11/4½	11/-	13/9	—	9/6	10/6	11/-	11/1½	13/6
Feb. 4..	9/0¼	9/1	9/-		11/9¾	11/9	10/10½	10/10½	13/9	—	9/6	10/6	10/10½	11/1½	13/6
11..	9/1½	9/2½	9/1½		12/-	12/1½	11/2¼	11/1½	14/1½	—	9/6	10/9	10/9	11/1½	13/9
18..	9/3	9/4	9/3		12/4½	12/6	11/4½	11/2¼	14/4½	—	9/6	10/9	10/9	11/3	14/-
25..	9/3½		9/-		12/4½	12/1½	11/3¾	10/9¾	14/-	—	9/-	10/6	10/10½	11/-	13/10½
March 4.	9/3½		8/9	8/9¾	12/3	12/1½	11/3	10/9	13/9	—	8/9	10/6	10/10½	11/-	14/-
11..	9/2½		8/11¼	9/-	12/1½	12/0¾	11/3	10/8¼	13/8¼	—	8/9	10/3	10/10½	11/-	14/-
18..	9/-		9/0¾	9/1½	12/3	12/5¼	11/3	10/9	13/11¼	—	8/9	10/3	11/-	11/-	14/-
25..	9/-	9/0¾	9/0¾	9/-	12/4½		11/-	10/7½	13/10½	—	8/9	10/6	11/-	11/-	14/-
April 1..	8/11¾	9/1¼	9/-		12/4½		11/-	10/6	13/10½	—	8/9	10/6	11/-	11/-	13/9
8..	9/1		8/9¾		12/5¼	12/7½	11/-	10/1½	14/0¾	—	8/6	10/9	11/0¾	10/10½	13/9
15..	9/0¼		8/8¼		12/7½	12/9	10/10½	10/0¾	14/3	—	8/6	11/-	11/0¾	10/6	14/-
22..	9/1	9/3¼	8/9		12/7½	12/8¼	11/1½	10/0¾	14/1½	—	8/6	11/-	11/1½	10/5¼	14/-
29..	9/4½	9/6	8/9		12/7½	12/6	11/4½	10/0¾	13/11¼	—	8/6	11/-	11/6	10/5¼	14/-
May 6..	9/2½	9/3¾	8/10½		12/4½	12/1½	11/3	10/0¾	13/7½	—	8/6	10/9	12/-	10/6	13/9
13..	9/4½	9/5½	8/9¾		12/4½	12/1½	11/4½	10/0¾	13/7½	—	8/6	10/9	12/-	10/6	13/9
20..	9/6	9/6½	8/8¼		12/-	11/6¾	11/6	10/0¾	13/3	—	8/6	10/6	12/3	10/6	13/9
27..	9/7	9/7½	8/9¾		11/6	11/-	11/6¾	10/3	12/10½	—	8/9	10/3	12/3	10/6	13/6
June 3..	9/8	9/9	8/8¼		10/6	10/7½	11/6¾	10/3	12/6	—	8/9	10/-	12/4½	10/6	13/-
10..	9/9½	9/9	8/7½		10/7½	10/4½	11/6	10/3	12/3	—	8/9	9/9	12/4½	10/4½	12/9
17..	9/8	9/8½	8/6¾		10/1½	10/3	11/3	10/3	12/4½	—	8/9	9/9	12/4½	10/4½	12/9
24..	9/7	9/6	8/6¾		9/9	10/3	11/3	10/3	12/3	—	8/9	9/6	12/4½	10/4½	12/6
July 1..	9/5	9/3	8/6		9/11¼	10/-	11/-	10/3	12/4½	—	8/9	9/6	12/3	10/4½	12/-
8..	9/4	9/2¾	8/5¼		9/9	9/10½	11/-	10/3	12/4½	—	8/9	9/3	12/-	10/4½	12/-
15..	9/3	9/3¾	8/5¼		9/9	9/7½	10/10½	10/3	—	—	8/9	9/3	11/9	10/4½	11/10½
22..	9/3	9/2½	8/3		9/2¼	9/3	10/8¼	10/0¾	—	—	8/6	9/-	11/7½	10/3	11/9
29..	9/3	9/3¾	8/4½		9/4½	9/6	10/8¼	10/1½	—	—	8/6	9/-	11/7½	10/3	11/7½
Aug. 5..	9/4	9/4½	8/6		9/9	10/-	10/9	10/3¾	—	—	8/6	9/3	11/6	10/6	11/7½
12..	9/5	9/4½	8/9		9/10½	9/6	10/9¾	10/6	—	—	8/6	9/-	11/7½	10/6	11/6
19..	9/3½	9/4	8/8¼		9/7½	9/8¼	10/10½	10/6	—	—	8/6	9/3	11/7½	10/6	11/7½
26..	9/4½	9/6	8/9	8/10½	9/7½	9/4½	11/0¾	10/7½	—	—	8/9	9/3	11/9	11/-	11/6
Sept. 2..	9/6	9/6½	8/10½		9/1½	8/11¼	11/1½	10/9	11/6¾	—	8/9	9/-	11/10½	11/-	11/6
9..	9/7	9/7½	9/0¾	9/-	8/10½	8/11¼	—	11/0¾	11/6¾	—	8/9	8/9	11/10½	11/-	11/6
16..	9/7½		9/0¾		8/10½	8/11¼	—	10/10½	11/6	—	8/9	8/9	11/10½	11/-	11/3
23..	9/6	9/6¾	9/-	8/11¼	9/-	9/1½	—	10/9	11/6	—	8/9	9/-	12/-	11/1½	11/3
30..	9/6¼	9/5¾	8/9	8/6¾	9/-	9/1½	—	10/1½	11/-	—	8/6	9/-	11/9	11/-	11/-
Oct. 7..	9/6½	9/7	8/9	8/7½	8/10½	8/8¼	—	10/3	11/-	—	8/6	9/-	11/9	11/-	10/9
14..	9/7	9/8	8/7½	8/6¾	8/9	8/10½	—	10/2¼	—	—	8/6	8/9	11/10½	10/10½	10/7½
21..	9/7½	9/8	8/6	8/5¼	8/11¼	9/0¾	11/10½	10/1½	—	—	8/4½	9/-	11/9	10/9	10/10½
28..	9/7½	9/8	8/5¼		9/-	9/1½	—	10/-	—	—	8/4¼	9/-	11/10½	10/9	10/10½
Nov. 4..	9/7	9/7½	8/6	8/6¾	9/1½		11/7½	10/2¼	—	—	8/4½	9/1½	11/10½	10/7½	11/-
11..	9/7½	9/8	8/7½	8/9	9/3	9/6	11/6¾	10/5¼	—	—	8/6	9/6	11/10½	10/7½	11/6
18..	9/9	9/10	8/10½	9/-	9/5¼	9/3¾	11/9	10/7½	—	—	8/6	9/9	12/-	10/9	11/10½
25..	10/-	10/2¼	8/9¾	8/11¼	9/3¾	9/2¼	11/10½	10/7½	—	—	—	9/9	12/1½	10/9	11/10½
Dec. 2..	10/2	10/1½	8/11¼	9/-	9/1½	9/2¼	11/10½	10/10½	11/0¾	—	—	9/9	12/1½	10/9	11/10½
9..	10/1½	10/0¾	9/-	9/0¾	9/1½	9/0¾	11/9	11/-	11/-	—	—	9/9	12/0¾	10/9	11/9
16..	9/6½	9/8	9/3	9/2¼	9/-	9/0¾	11/4½	11/-	11/-	—	—	9/9	11/9	10/9	11/7½
23..	9/8	9/9	9/3	9/6	9/0¾		11/4½	11/6	10/9¾	—	—	9/9	11/7½	11/-	11/7½
30..	9/6	9/5½	9/6	9/7½	9/1½	9/2¼	10/10½	—	10/11¼	—	—	9/9	11/7½	11/3	11/6

PRICES OF RAW AND REFINED SUGAR,

of 1898, 1897, and 1896.

	Tate's Cubes. No. 1.			Tate's Cubes. No. 2.			First Marks German Granulated f. o. b.			Say's Cubes f. o. b.			German & Austrian † Cubes f. o. b.		
	1898.	1897.	1896.	1898.	1897.	1896.	1898.	1897.	1896.	1898.	1897.	1896.	1898.	1897.	1896.
Jan. 7..	15/-	15/3	17/6	14/1½	14/3	16/9	11/-	11/3	12/9	13/3	13/6	15/6	12/4½	12/3	13/10½
14..	14/10½	15/3	17/9	14/-	14/3	16/9	10/11¼	11/3¾	13/-	13/3	13/6	15/6	12/4½	12/1½	14/1½
21..	14/9	15/3	18/3	13/10½	14/3	17/3	10/9¼	11/3	13/3	13/-	13/6	16/-	12/3	12/-	14/6
28..	14/9	15/3	18/6	13/10½	14/3	17/6	10/9¾	11/1½	13/4½	12/9	13/6	16/3	12/-	12/-	14/7½
Feb. 4..	14/9	15/3	18/3	13/10½	14/3	17/3	10/9¾	11/1½	13/3	12/7½	13/6	16/3	12/-	11/10½	14/7½
11..	14/9	15/3	18/3	13/10½	14/3	17/3	10/11¼	11/3	13/7½	12/6	13/6	16/6	12/-	11/10½	14/10½
18..	14/10½	15/3	18/9	14/-	14/3	17/9	11/1½	11/4½	14/-	12/7½	13/6	16/9	12/-	11/10½	15/3
25..	14/10½	15/3	18/6	14/-	14/3	17/6	11/0¾	10/11¼	13/8¼	12/7½	13/6	16/6	12/1½	11/9	15/-
March 4..	14/9	15/3	18/3	13/10½	14/3	17/3	11/0¾	10/6	13/7½	12/7½	13/3	16/6	12/-	11/9	14/9
11..	14/9	15/3	18/-	13/10½	14/3	17/-	10/10½	10/7½	13/4½	12/6	13/3	—	12/-	11/7½	14/7½
18..	14/9	15/3	18/-	13/9	14/3	17/-	10/9	10/9	13/8¼	12/6	13/3	—	11/10½	11/7½	14/9
25..	14/9	15/3	18/-	13/9	14/3	17/-	10/10½	10/7½	13/9	12/4½	13/-	—	11/10½	11/7½	14/10½
April 1..	14/9	15/3	18/-	13/9	14/3	17/-	10/11¼	10/7½	13/9	12/4½	13/-	—	11/10½	11/7½	14/10½
8..	14/9	15/3	18/-	13/9	14/3	17/-	10/9¼	10/6¾	14/-	12/4½	12/9	16/6	11/10½	11/7½	14/10½
15..	14/9	15/3	18/3	13/9	14/3	17/3	10/9	10/6	14/4½	12/3	12/6	16/6	11/9	11/6	15/1½
22..	15/-	15/3	18/3	14/-	14/3	17/3	11/-	10/6	14/3¾	12/6	12/6	16/6	11/10½	11/6	15/-
29..	15/6	15/3	18/3	14/6	14/3	17/3	11/3¾	10/7½	14/1½	13/3	12/6	16/6	12/4½	11/6	15/-
May 6..	15/6	15/3	18/-	14/6	14/3	17/-	11/0¾	10/7½	13/8¼	13/3	12/6	16/-	12/4½	11/7½	14/9
13..	15/4½	15/3	18/-	14/4½	14/3	17/-	11/3	10/7½	13/9	13/3	12/6	16/-	12/4½	11/7½	14/9
20..	15/6	15/3	17/6	14/6	14/3	16/6	11/4½	10/6¾	13/6	13/4½	12/6	15/9	12/4½	11/6	14/6
27..	15/6	15/3	17/6	14/6	14/3	16/6	11/5¼	10/8¼	12/11¼	13/4½	12/6	14/10½	12/7½	11/7½	14/3
June 3..	15/6	15/3	17/-	14/6	14/3	16/-	11/5¼	10/7½	12/6¾	13/-	12/9	14/10½	12/7½	11/6¾	13/9
10..	15/6	15/3	17/-	14/6	14/3	16/-	11/3¾	10/7½	12/2¼	13/-	12/9	14/10½	12/6	11/6¾	13/6
17..	15/4½	15/3	16/9	14/4½	14/3	15/9	11/3¾	10/7½	12/0¾	13/-	12/9	14/9	12/4½	11/6¾	13/4½
24..	15/4½	15/3	16/6	14/4½	14/3	15/6	11/0¾	10/9	12/2¼	13/-	12/6	14/9	12/4½	11/6¾	13/1½
July 1..	15/3	15/-	16/6	14/3	14/-	15/6	10/10½	10/8¼	12/-	12/9	12/6	14/10½	12/3	11/6¾	13/1½
8..	15/3	15/-	16/3	14/3	14/-	15/3	10/9	10/8¼	11/9	12/9	12/6	14/10½	12/3	11/6¾	12/10½
15..	15/3	15/-	16/3	14/3	14/-	15/3	10/9¾	10/7½	11/6¾	12/7½	12/6	14/6	12/1½	11/6	12/10½
22..	15/-	15/-	16/-	14/-	14/-	15/-	10/9	10/5¼	11/3	12/7½	12/6	14/6	12/-	11/6	12/6
29..	15/-	14/6	16/-	14/-	13/6	15/-	10/9¾	10/5¼	11/4½	12/6	12/6	14/3	12/-	11/6	12/6
Aug. 5..	15/-	14/6	16/-	14/-	13/6	15/-	11/-	10/6¾	11/10½	12/7½	12/6	14/-	12/1½	11/6	12/9
12..	15/-	14/6	16/-	14/-	13/9	15/-	11/1½	10/8¼	11/5¼	12/10½	12/7½	14/-	12/4½	11/7½	12/9
19..	15/-	14/7½	16/-	14/-	13/10½	15/-	11/2¼	10/9	11/7½	12/10½	12/6	14/-	12/4½	11/9	12/9
26..	15/-	14/9	15/9	14/-	14/-	14/9	11/6	11/-	11/5¼	13/3	12/7½	14/-	12/7½	12/-	12/9
Sept. 2..	15/3	14/10½	15/6	14/3	14/1½	14/6	11/6	11/1½	11/0¾	13/3	12/7½	14/-	12/7½	12/1½	12/6
9..	15/3	15/-	15/6	14/3	14/3	14/6	11/7½	11/4½	10/11¼	13/3	12/9	14/-	12/9	12/3	12/6
16..	15/3	14/9	15/6	14/3	14/-	14/6	11/8¼	11/3	10/10½	13/3	12/7½	14/-	12/9	12/3	12/6
23..	15/3	14/9	15/6	14/3	13/9	14/6	11/8¼	11/2¼	11/0¾	13/3	12/6	13/6	12/9	12/3	12/6
30..	15/3	14/6	15/6	14/3	13/6	14/6	11/9	10/8¼	11/-	13/3	12/6	13/6	12/9	12/-	12/4½
Oct. 7..	15/3	14/6	15/3	14/3	13/6	14/3	11/9	10/8¼	10/8¼	13/3	12/6	13/6	12/9	11/10½	12/4½
14..	15/3	14/6	15/3	14/3	13/6	14/6	11/9	10/7½	10/7½	13/3	12/3	13/6	12/9	11/9	12/-
21..	15/3	14/6	15/3	14/3	13/6	14/3	11/8¼	10/4½	10/9	13/3	12/3	13/6	12/9	11/7½	12/-
28..	15/6	14/6	15/3	14/6	13/6	14/3	11/7½	10/3¾	10/9	13/6	12/3	13/6	12/9	11/6	12/1½
Nov. 4..	15/6	14/6	15/3	14/6	13/6	14/3	11/6¾	10/6	10/9¾	13/3	12/3	13/9	12/9	11/6	12/3
11..	15/6	14/6	15/3	14/6	13/6	14/3	11/5¼	10/7½	10/11¼	13/3	12/6	14/-	12/9	11/9	12/6
18..	15/9	14/7½	15/3	14/9	13/7½	14/3	11/7½	10/9¾	10/9¾	13/3	12/7½	14/-	12/10½	11/10½	12/3
25..	15/10½	14/6	15/3	14/10½	13/6	14/3	11/8¼	10/7½	10/10½	13/6	12/7½	14/-	13/1½	11/10½	12/4½
Dec. 2..	15/10½	14/6	15/3	14/10½	13/6	14/3	11/6¾	10/10½	10/10½	13/6	12/9	14/-	13/1½	11/10½	12/3
9..	15/10½	14/6	15/3	14/10½	13/7½	14/3	11/6¾	11/-	10/10½	13/4½	12/9	13/9	13/1½	12/-	12/3
16..	15/9	14/9	15/3	14/9	13/10½	14/3	11/3	11/-	11/-	13/3	13/-	13/9	12/10½	12/-	12/3
23..	15/7½	14/10½	15/3	14/7½	14/-	14/3	11/1½	11/2¼	11/1½	13/3	13/-	13/6	12/9	12/3	12/3
30..	15/6	14/10½	15/3	14/6	14/-	14/3	11/-	11/3	11/1½	13/-	13/3	13/6	12/6	12/4½	12/3

* Tate's Cubes closed 6d. above these prices. † Basis average Hansa ACL FMS.

H. H. HANCOCK & Co., 39, Mincing Lane, London, E.C.

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1899. Tons.		1898. Tons.
Total Receipts, 1st Jan. to 9th Feb. ..	143,942	..	79,133
Receipts of Refined ,, ,, ,, ..	820	..	3,475
Deliveries since 1st January	148,112	..	90,893
Consumption (4 Ports, Exports deducted) since 1st January	151,027	..	111,357
Importers' Stocks (4 Ports) Feb. 8th....	1,301	..	57,956
Total Stocks, February 22nd	121,000	..	209,937
Stocks in Cuban Ports, February 22nd..	33,000	..	75,000
	1898.		1897.
Total Consumption for twelve months ..	2,047,344	..	2,071,413

CUBA.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, 1898 AND 1899.

(Tons of 2,240lbs.)	1898. Tons.		1899. Tons.
Exports	22,660	..	8,382
Stocks	42,069	..	20,009
	64,129		28,391
Local Consumption (one month)	3,500	..	3,600
	67,629		31,991
Stocks on the 1st January (old crop)	1,515	..	4,336
Receipts at Ports up to 31st January..	66,114	..	27,655

JOAQUIN GUMA.

UNITED KINGDOM.

STATEMENT OF ONE MONTH'S IMPORTS, EXPORTS, AND CONSUMPTION FOR THREE YEARS.

	1899. Tons.		1898. Tons.		1897. Tons.
Stock, 1st January	76,930	..	90,030	..	139,623
Imports, Raw Sugar, Jan. 1st to 31st	43,647	..	80,125	..	40,971
,, Refined, Jan. 1st to 31st	65,388	..	50,840	..	54,114
,, Molasses, Jan. 1st to 31st	3,282	..	2,717	..	4,524
	189,247		223,712		239,232
Stock, in 4 chief Ports, Jan. 31st	69,807	..	106,380	..	128,061
	119,440		117,332		111,171
Exports (Foreign, and British Refined) ..	6,386	..	8,702	..	5,885
Apparent Consumption for One month ..	113,054		108,630		105,286

Stocks of Sugar in Europe at uneven dates, February 1st to 15th, compared with previous Years.

In thousands of tons, to the nearest thousand.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	Total 1899.
64	905	630	604	199	2402

	1898.	1897.	1896.	1895.
Totals	2467 ..	2673 ..	2435 ..	2143

Twelve Months' Consumption of Sugar in Europe for Three Years, ending 31st January, in thousands of tons.

Great Britain.	Germany	France.	Austria.	Holland, Belgium, &c.	Total 1898-99.	Total 1897-98.	Total 1896-97.
1654	759	558	358	433	3762	3642	3415

Estimated Crop of Beetroot Sugar on the Continent of Europe for the current Campaign, compared with the actual crop of the three previous Campaigns.

(From Licht's Monthly Circular.)

	1898-99. Tons.	1897-98. Tons.	1896-97. Tons.	1895-96. Tons.
Germany	1,710,000 ..	1,852,857 ..	1,836,536 ..	1,615,111
Austria	1,040,000 ..	831,667 ..	934,007 ..	791,405
France	835,000 ..	821,235 ..	752,081 ..	667,853
Russia	745,000 ..	738,715 ..	714,936 ..	712,096
Belgium........	220,000 ..	265,397 ..	288,009 ..	235,795
Holland........	155,000 ..	125,658 ..	174,206 ..	106,829
Other Countries..	160,000 ..	196,245 ..	202,990 ..	156,340
	4,865,000	4,831,774	4,902,765	4,285,429

Only unimportant alterations have been made in Mr. Licht's February circular, viz., France, 5,000 tons more, and Russia and Holland each 5,000 tons less.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

The market at the opening of February was characterised by greater firmness, and the quantity on offer being but small, prices of beet advanced and cane sugars were held for full prices or a slight advance. A large quantity of beet being then thrown on the market, owing to French speculative movements, prices of beet again gave way, but with very small arrivals those for cane were fully maintained. At the end of the month there was a distinct reaction, and as American buyers have again begun to operate to some extent, probably owing to the growing certainty of a smaller Cuban crop than had been expected some weeks ago, there was a recovery in the prices of beet, and cane prices at the end of the month are from 3d. to 6d. above the quotations of our last report. There is also a probability of a very short supply from the Philippines, owing to the progress of the armed opposition to the American occupation, and this being just the time when the crop should be secured, it seems likely that little or no work can be done, as the insurrection is general. There is really no feature of novelty to report, and what we stated in our last report as to prospects still holds good, excepting that our anticipations as to the Cuban crop have now been fully verified, the probable total quantity now being expected to fall below 300,000 tons.

The following quotations are in all cases for prompt delivery :—

			Last Month.
Porto Rico, fair to good Refining	10/6 to 11/0	against	10/0 to 10/9
Cuba Centrifugals, 97°/₀ polarization....	11/3 to 11/6	,,	11/0
Java, No. 14 to 15 D.S.	11/9 to 12/0	,,	11/3
British West India, fair brown	10/0 to 10/6	,,	9/9 to 10/9
Bahia, low to middling brown	9/0 to 9/6	,,	8/9 to 9/0
,, Nos. 8 and 9..	9/6	,,	9/0 to 9/3
Pernams, regular to superior Americanos.	9/6 to 9/9	,,	9/0 to 9/3
Madras Cane Jaggery..	9/0 to 9/3	,,	9/0
Manila Taals	8/9	,,	8/6
French Crystals, No. 3, f.o.b.	11/0	,,	10/9
Russian Crystals, c.i.f..	?	,,	?
German granulated, f.o.b.	11/2½	,,	11/0
Tate's Cubes..	15/3	,,	15/1½
Beet, German and Austrian, 88%, f.o.b...	9/8½	,,	9/4½

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☞ All communications to be addressed to Edward Sutton, 24, Seymour Road, Manchester.

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☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

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The great event of the past month in the sugar world has been the prompt enactment of countervailing duties on beet sugar receiving bounties and imported into India.

As might be expected, the whole of the Opposition press has been crying out in consternation over this salutary action on the part of the Indian Government and the Secretary of State for India, and, naturally a great number of letters have appeared in the public press, in many cases with the view of correcting the numerous mistatements which have been made in all directions. The number of these letters is so large that we could not possibly find room even for a résumé of the many able and conclusive replies that have been given to the erroneous assertions of the champions of supposed Free Trade. We are in no way surprised at this consternation on the part of the Opposition and its organs, who have also been opponents of any measure calculated to relieve the present chronically unsound situation of the sugar industry, for it is not too much to expect that the Government will at last see its way to propose the establishment of countervailing duties in this country also, which would be the salvation of the sugar industry in general. But we do strongly object to many of the statements that have been freely made both by public

speakers and by the (?) Liberal press, which constitute a complete begging of the questions at issue, and are based upon an unfair, one-sided, and (we regret to have to say it) occasionally wilfully ignorant view of the facts connected with the Indian sugar production and its distribution and consumption.

This action of the Indian Government has of course received close attention on the part of Continental beet growers. It is stated that Austria has already entered a protest, which she is entitled to do under the provisions of the existing treaty of commerce. Germany is debarred from this, as in her case our Colonies are not affected by the most-favoured-nation clause. The *Deutsche Zuckerindustrie* (most inexplicably to us) expects an advance in the price of beet sugar to result from the countervailing duties! The partisans of the abolition of premiums and the inland tax on consumption, who constitute a fairly numerous class in Germany, are by no means dissatisfied with the proceeding, and consider it as an incentive to more vigorous action.

The present number contains in its entirety the paper on Mauritius of which we gave an extract in our January number. We are informed that the 1898-99 crop in that island will be the largest on record, reaching 185,000 metric tons or over. This is over 50 per cent. more than the last crop and 20 per cent. more than that of 1896-97, which was up to now the largest known. A late telegram reports a very favourable season and good beneficial rains.

The *Sucrerie Indigène* gives the following figures for the two last years' exports from Guadeloupe:—

	1897.		1898.
Sugar............tons	40,126	....	37,135
Molasses ....gals.	1,012,156	....	703,154
Rum .... ,,	465,653	....	486,308

In Chili it is proposed to grant a premium (bounty) of 2 cents. on every kilo. of raw beet sugar produced in the country. In Switzerland also a premium is to be given for the first five years of 10 centimes per double centner of beets grown in Canton Aarau.

An article on "golden syrup" is commenced in the present number. Since this portion was written another prosecution has taken place in Southwark (London), the offender being fined £3 12s. 6d.

INDIA.

COUNTERVAILING DUTIES.

In our issue for last month we mentioned having received, by the kindness of the Cawnpore Sugar Works, Limited, full details of the steps taken to awaken the Indian Government to the danger to the native industry arising from the importation of bounty-fed refined sugars. At that time the replies received up to date from the higher officials, to whom very full and accurate details had been forwarded, did not seem by any means satisfactory or likely to result in inducing the Indian Government to take decisive measures, and we had intended to give a tolerably full summary of what had been done. This is now happily rendered unnecessary by the prompt and most praiseworthy and statesmanlike decision arrived at by the Indian Council, which has both clearly grasped the situation and, after due enquiry, applied the only possible remedy by imposing countervailing duties, which came into force at once, viz., on the 20th ult., and will effectually put a stop to the unfair competition of all bounty-fed sugars. It is satisfactory and re-assuring to find that while in our country almost any meddlesome doctrinaire mediocrity has more or less chance of hindering or even stopping the enactment of sound legislation, in our great dependency vigorous and effectual action can, when necessary, be taken without fear of democratic interference. We congratulate the Indian sugar refiners on the much-needed relief they have obtained, and earnestly hope it may prove an omen of future success in the same direction for the help of our sorely distressed British refining industry.

It may be useful to append the two following tables taken from the papers supplied to us.

Imports (in cwts.) into British India of Refined Beet Sugar.

From	1888-89.	1889-90.	1890-91.	1891-92.	1892-93.
Austria	196	3,087	31,374	22,503	27,698
Belgium	1,402	3,497	25,044	1	2,107
France	757	3,979	9,356	15,409	317
Germany	—	40,734	701,195	242,705	255,788

From	1893-94.	1894-95.	1895-96.	1896-97.	1897-98.
Austria	11,549	7,093	4,934	115,514	945,745
Belgium	325	—	1,064	5,940	9,205
France	233	488	433	115	23,825
Germany	189,301	274,632	718,218	758,218	1,203,309

Of the sugar imported into India in 1897-98, total 215,048 tons, very nearly one half, viz., 107,383 tons, was from Europe.

THE SUGAR INDUSTRY OF MAURITIUS.

By James Forrester Anderson, F.R.G.S.

Paper read at a meeting of the Royal Colonial Institute, December 13th, 1898.

In presenting this Institute with a paper on the sugar industry in Mauritius, that fair isle of my birth, I will endeavour to condense the numerous heads of information with which the subject is replete, into such form as the short time of an afternoon lecture will allow, and shall do my best to make the paper as interesting as I can. I will therefore ask to be excused if I but touch lightly on statistics which, as a rule, make up the dry side of a lecture. I shall not occupy your time by introducing my native island-home to you, geographically or ethnologically. I take it for granted that most of you, if not all of you, know where "Le Malte de l'Océan Indien," as Monsieur Thiers calls it (the Malta of the Indian Ocean) is situated. Moreover any one can gather a good deal of information about the island, now rightly designated as the "Stella clavisque maris Indici" (the Star and Key of the Indian Sea), from the admirable paper read before this Institute by our worthy chairman, Mr. Jourdain, in April, 1882.

In speaking of the sugar industry, one is necessarily desirous to know what is that substance called sugar, and where it comes from. It is not my purpose to give you the technical definition of sugar, but I will only remind you that substance may be obtained from innumerable bodies called Carbo-Hydrates, containing the elements Carbon, Hydrogen, and Oxygen. We have to deal in this paper with cane-sugar and no other, suffice it to say that it is the chief ingredient of the grass-plant, the sugar cane (Saccharum Spontaneum L.), from which it is extracted. We shall therefore begin by speaking of the sugar-cane in Mauritius, we shall tell of its introduction in that island, the manner in which it is planted or sown, as the case may be, and the process by which sugar is obtained from it, and finally touch upon the state of the sugar industry, past and present, in the island.

The sugar cane is said to have been introduced in Mauritius about the year 1747 by the French, from the Dutch East Indies, during the governorship of Mahé de Labourdonnais, when the island was called "Ile de France;" it retained that name throughout the French occupation from 1721 to 1810. A usual way of planting the cane at that time was by sections of the stem (cuttings) in furrows; from a small acre-

age at first, large fields were covered with it; two or three years later, about 1750, we find the first sugar factory at work, that of Mahé de la Villebague, brother of the governor, in the northern district of "Pamplemousses." I am not prepared to affirm that the sugar-cane, at the time of its introduction in the island, or soon after, was propagated by seeds; but I am able to state that the propagation of the sacchariferous reed from seeds became a thing of reality only in the last eight or nine years, while in Barbados, in the West Indies, our fellow-planters were ahead of us in that respect. More than one "seânce" of our Royal Society of Arts and Sciences of Mauritius, some thirteen years ago, were taken up with the discussion of this question of cane-seedlings, but no practical result was arrived at by our scientists, and the matter did not germinate. In the latter part of 1889 or the commencement of 1890, an intelligent planter, Mr. Perronat, studied the question, and with seeds from the West Indies he made several experiments which produced such satisfactory results that he is reaping a fairly good harvest of rupees from his seedling-canes. These canes are very fine, and are very promising in their yield of sugar; the best yield of sugar, however, does not always depend on the beauty and stoutness of canes, there are certain species of canes which look very slim, but which give more sugar than many bigger species. For example, the "Bois-rouge" and the "Chef-Branchue," two thin and comparatively short species, have been known to yield much more sugar than the "Lourde," a heavy, stout, and tall cane, which to my knowledge has yielded half the quantity of the two thinner canes, these last however have now disappeared. chiefly so the "Bois-rouge." Among the canes that have hitherto produced the largest crop of sugar are the "Diard" and the "Bellouguet," chiefly the latter, which in the central parts of the island, some thirty and odd years ago, on "Bonne Mêre" and "Trianon" Estates gave an average yield of five and six tons of sugar per "arpent," (about $1\frac{1}{4}$ acre) but it is now a tale of the past, such kinds having disappeared by the havoc of that destructive insect, the "Borer," as well as from the degeneration due to exhaustion of the soil and the overplanting of the same stock in the same soil from year to year. When the Mauritius planter now-a-days realises an average yield of two or two and a half tons of sugar per acre from his canes, he considers himself very fortunate, for with a lower average than two tons he would be working at a loss, considering the low market price of sugar at the present day.

The usual way of planting the cane to-day, in Mauritius, is to take two "tops" or heads of the species and place them together with a thin layer of soil over them, in short trenches ("fossés") 12 inches by 5 and 6 deep, eight inches apart from each other; these "fossés" are carried across the field leaving a space between the rows, of three or four feet. Within a week, generally, the nodes or the "eyes" (as we term them locally) in each joint spring out, and when the young shoots are 12 to 14 in. high a handful of guano or chemical manure sprinkled round them speedily transforms the feeble shoots into an abundant and luxurious growth. On attaining 12 or 14 in. more above the level of the ground, a basketful (20 or 25 lbs.) of prepared stable manure, from dunghills twelve or fifteen months old, is strewn all round the plant and covered with a layer of the surrounding soil; with this double and rich nourishment a clump or "stool" of some twenty or more stems springs up under the beneficial influence of sunshine and rain. In due time the eyes of the planter are gladdened by the matured growth of the canes reaching some ten or twelve feet high and beautiful with varied tints, from which the long green ribbon-like leaves droop while the plumes of silver-grey flowers wave overhead. The "cutter" (the local term for the "reaper") then comes with his knife or bill-hook and cuts down the canes an inch or two from the roots, to be carted to the "usine" or factory, where they are crushed by the powerful steam-rollers. The age of maturity of the cane is not alike in all the species: some canes will ripen after twelve months' virgin-growth, others after thirteen or fifteen—by virgin-growth is meant the first growth from the time of planting; the first canes of this first growth are the virgin canes. After the cutting of the virgin canes the stumps are left in the soil and made to reproduce fresh shoots by the same means of guanoing or manuring, as at first—at the time of maturity. These canes, now termed "first ratoons," are cut down and carted to the factory to be crushed by the steam-rollers. Some species are allowed to reproduce up to the "third ratoons." Fifteen and twenty years ago "fifth ratoons" were frequently to be seen in a field, but at that time the planter was fortunate in being able to make use of a very rich Peruvian guano, the "Chinchas" (the deposit of which is now extinct), which worked wonders. On the other hand, experience, which is the best school of life "though the fees are high," has shewn that with the best species it is wiser to stop with the second ratoons at the utmost, in order to obtain a remunerative result and at the same time prevent the

degeneration of the species, which fact did not trouble the minds of our predecessors fifty years ago when, for instance, the fourth ratoons of the "bamboo" cane gave as much as three tons of sugar per acre, and when the soil needed not half the artificial manure it does to-day. The impoverishment or exhaustion of the soil may be easily understood when we find estates which have been planted annually with sugar cane for the last eighty or ninety years; hence the abundance of guano and manure which is now required to restore the vital energies of the soil. A remarkable fact which does not escape the planter's observation is the difference in the crops or yield from the same species of cane planted in different parts of one and the same estate. To my personal knowledge—on an estate in the south of the island, the same species of cane has produced more sugar in the higher parts of the estate than in the lower parts bordering the sea; another species producing more sugar in the lower region than in the higher. Therefore we can easily understand how chary the Mauritius planter is concerning the varieties of the species of cane he cultivates, and specially the chemical composition of the soil in the various parts of his estate, so that he may know exactly the nature of the guano and manure which he must use. Experience has taught him now that the greater the variety of species, the greater the result—the more abundant the yield of sugar.

In days gone by, an estate was seldom seen or heard of which had altogether more than two species throughout its plantations. These questions did not in those days claim such close attention and study from our predecessors as they do now from us, who, when able to afford it, go to the expense of a certificated agricultural chemist and of a proper laboratory for the purpose of solving such vital problems of our present day agriculture. I have heard of an estate which had only one species of cane, the "canne blanche" (white cane) that gave a very good yield, but unfortunately was the first in the Island to be attacked by disease; this was about 1835 or 1840. Before this and even for some time after, the planter, with the remarkable fertility of his lands maintained by the existence of the thick wood around all the water-courses in the highlands of the country, did not find himself compelled to add to the soil two or three ounces of Peruvian Guano at Rs. 160 and Rs. 180 a ton, and other costly manures, but simply basked in the sunshine of prosperity with an average yield of five tons of sugar per acre, and a market-price of 28s to 30s per cwt., leaving all "á la grâce de Dieu." At that period the northern districts of

"Pamplemousses" and "Rivière du Rampart" were the most fertile region for the sugar-cane, but since 1860 or thereabouts, the Central and a part of the Southern districts have surpassed the North in production; this change of scene is mainly due to deforestation brought on by the eagerness of the Mauritian to cultivate the sugar-cane and nothing else to speak of, so that every acre of land was turned into a a cane-field, hence the land had to be cleared of every bit of wood it happened to have on it. This yearning for the sugar-cane, transmitted from generation to generation among the Mauritian families, and which has a peculiar attractiveness for the mind of the new comer, is due to the inestimable value of the sacchariferous reed, for it is undoubtedly one of the best economic plants which Providence has given to the inhabitant of the intertropical region. When the cane has reached maturity, the dry leaves, which are removed by hand from the stem, are either carted to the yard of the factory to be stored in the large sheds to serve as fuel, or are buried a foot or two deep in the space between the rows of canes in the field in order to keep up the richness of the soil by contributing thereto the potash salts they contain, this last alternative is now being universally adopted Another use of the dry leaves of the cane is for thatching, but this is gradually being abandoned from the fact that a large quantity is needed for the purpose, also from their being an easy prey to a single spark of fire. The green leaves of the cane which crown its top are used as forage for the mules and cattle. The top or head of the cane is the most valuable part of the plant, for without it the species cannot be propagated, and the flower to-day is the source of the seeds from which the species are derived. The cane itself, after being crushed by the steam rollers and reduced to a mere dry fibrous pulp called "bagasse" or "mégasse" is conveyed to the furnaces as fuel, the ash of the bagasse is gathered and used as manure, the refuse from the juice after filtration, called "petite bagasse" (small cane trash) is also gathered and mixed up with the manure. The roots of the cane when dug out of the ground are often carted to the sheds to serve as fuel, or left in the field for the labourers, who use them as fuel in their huts, so that in the sugar-cane there is absolutely nothing lost in the service of man. There is no doubt that the "bagasse" could be turned into some important industry, such as paper, which has been tried in the Island already, or carpeting or matting, or as an Irish friend of mine observed on picking up some of it, and using his olfactory powers, "Faith, whiskey could be got out of this," but the

Mauritian planter will not so easily part with his bagasse. Apart from this priceless article of fuel, the planter who, in Mauritius, is at the same time a sugar-maker, must have a certain amount of firewood to start working his "Usine," unless he has been fortunate to have a sufficient supply of "bagasse" in his sheds left from the preceding "crop" or harvest, but this is not often the case now that the new furnaces (Fours-à-gradins, etc), introduced from this country, and especially from France, consume large quantities of bagasse. Fuel is a most important item in the planter's budget, as much so as the guano item; the fuel question is getting more and more serious year by year, as the supply of wood in the Island is hardly adequate to the demand. This, however, is a minor difficulty among many others which the planter has to face in Mauritius, such as drought, disease, etc. It is not difficult to explain the prolonged droughts which at times fill our hearts with despair, when we find our beautiful forests completely depleted to make room for the cane, a criminal act (I know no other definition) which has caused untold injury to the salubrity of the Island and which has been the cause of the ruin of many an estate in the lowlands bordering the sea as well as many in the Northern Districts, deforestation producing stagnation of the water-courses, and bringing desolation into localities once smiling with luxuriant vegetation and happy with a thriving population, and where the fatal malaria was an unknown factor. One is at once prone to ask: Is there no remedy to this? *The only radical remedy is for the Government to buy up all the lands surrounding the sources of the rivers and of the water-courses that supply water to the lowlands*, and rewood those lands with good and hardy forest trees; this alone will maintain the continuous supply of the water springing up from the sources and restore health and prosperity to those parched up and now desolate regions where no one cares to plant the sugar-cane or even the cabbage, and "a fortiori" to pitch his tent. Alas! our Mauritius Government has lately been and is still passing through great financial difficulties which preclude it from doing anything in that direction, but the Mauritians will not and cannot believe for a moment that the Home Government will refuse to give them a helping hand in this vital question of reforestation. Besides the droughts occasioned by the drying up of the water-courses, due to deforestation, the Mauritius planter has to battle against the various diseases which have been attacking different species of cane these last fifty years or more. As in the West Indies so in Mauritius, a widespread disease is caused by

a fungus, chiefly the *Trichosphoeria*, an account of which will be found in the Royal-Gardens-Kew Bulletin of July 1893, by Mr. G. Massee—also by an Acarus, the *Sarsonymus*, a microscopic insect attacking the cane chiefly under the leaves, this pest is commonly known as "rust," appearing as red spots; it attacks the young shoots, principally where the conditions of cultivation are defective. The planter cannot take too much care in selecting his cane-tops for planting and rejecting all suspicious-looking ones. The very interesting observations of Dr. Bancroft on the diseases of the sugar-cane in the Kew Bulletin of April 1890 are worth consulting. Above all diseases there is the invisible foe of the planter, the *Xyleborus perforans*, the "Borer," so ably described by Mr. Blandford, F.L.S., in his elaborate report on the subject, published in the Kew Bulletin for July and August, 1892. The "Borer" is said to have been observed for the first time in Mauritius on "Mon Loisir" Estate in the Northern District about the year 1848; the old planters believe it to have been first seen in the "Penang" cane, at the time one of the richest species. The only remedy is to cut away the contaminated young shoot and burn it; the brown and dried appearance of the leaf is a sure indication of the devastations of one or two of these pests, very often a whole clump or stool of young shoots is eaten up by these destructive insects. It is an amusing sight to see a special gang of *chocras* (young Indian boys), from five to ten years old, in a field with a glass bottle (generally an empty quinine bottle with a wide mouth) hanging on their bare breasts, into which they throw the full-grown larva of the insect, carefully extracted from the contaminated stem by means of a small sharp-pointed knife, the stem being cut away as far down the root as possible to be burned. The main object of the planter is to ensure the vitality of the canes, so that they may resist the attacks of disease and of insects, by selecting sound, healthy "tops" or good genuine canes from seeds, planting them in the right season, of which there are two in the year, namely, the "grande" (long) and the "petite" (short) seasons; the first, extending from October to January, is now as a rule the only season universally observed.

We generally speak of the sword of Damocles hanging over the head of a man risking his life and his money, but the Mauritius planter has not less than three sharp swords of Damocles hanging over his head. I have mentioned two already, drought and disease or borer; the other is by no means the least, being the most terrible of the three, for it can sweep away in one hour the labour and toil of

many long years; our West Indian fellow-planters have just had a sad experience of this indomitable foe. On the 29th of April, 1892, our little island was visited by one of these foes, when hundreds, nay thousands, of acres of beautiful luxuriant cane-fields were cut down and uprooted in every direction, nine-tenths of the sugar factories unroofed and seriously damaged, all the "camps" (the groups of the labourers' huts) on every estate razed to the ground within the space of one hour and a half, the havoc made by a terrific cyclone (unheard of in the memory of man for its fierceness) killing at the same time hundreds of men, women, and children; outside the sugar estates no less than twelve hundred perished, and two thousand were injured in the single town of Port Louis. In that memorably sad year the sugar crop, which promised to be the finest on record for the past decade, was reduced by thirty thousand tons on the preceding (from 124,000 to 94,000), and in the following year, 1893-1894, reached only 87,000 tons. The Mauritians, planters and everybody else in the island, will never be able sufficiently to express their heart-felt thanks to the British public and to all others who so readily came to their help in such a time of trouble and distress. Thank God! such calamities do not befall the island every year or even every decade, I might venture to say, but the planter passes through very anxious times from the month of October to the month of May, the cyclone season so called; as he wakes up in the morning his eyes scan his barometer (an indispensable piece of furniture in the Mauritian home), at noon he refers to it once more, and at night ere he retires to a well-earned repose he consults his weather-glass again.

When the cane is carted to the usine or factory it must be thrown between the steam rollers immediately, for exposure of the cut cane in the open air over twenty-four hours brings on fermentation of the saccharine juice which it contains; this is not uniform in all species, but as a rule such a long exposure is to be avoided. The complex machinery through which the juice has to pass after flowing from the rollers before it is converted into crystallised sugar is very interesting and to an outsider somewhat marvellous. The present-day "usine" in Mauritius, which produces from 25,000 to 30,000lbs. of sugar per day, with all its mechanical up-to-date appliances for the extraction of the largest quantity of sugar from the cane, leaves nothing to be desired, the planter is but too happy to adopt any new improved piece of machinery which will ensure a larger extraction of sugar, provided he has sufficient capital in hand; unfortunately the times are getting

harder every year for the sugar cane planter in all the sugar-producing colonies, owing to the abnormal and unfair competition of the bounty-fed beet sugar in the markets of Europe, India, &c.

Time will not permit me to speak of the improvements in machinery which have superseded the original rudimentary appliances of bygone years, such as the powerful steam mills with immense iron rollers from the firms of Blaikie Bros., of Aberdeen, Smith & Cook, of Glasgow, Fives-Lille, & Cail, of Paris, which have taken the place of the old wooden cylinders worked by animal and water power—locally termed at the time "Système Nalartic"—of the "Triple Effect," and of the vacuum-pan, and of the large copper pans (the Defecators), all replacing the "Wetzels" and the "Battery" of the immense open iron boiling pans, for the sake of economy in fuel and in steam, also for a better concentration and clarification of the juice, implying above all an economy of time and of hands. In some "usines" the crystallised mass of sugar (the masse-cuite) from the vacuum pan is conveyed direct to the centrifugals, where it is converted into white, grey, or yellow crystals, as the case may be, but many sugar makers believe this to be rather unprofitable, as this immediate transfer to the centrifugals (turbines) gives a smaller quantity of the first *jet* of sugar (the vesou-sugar) than would be desired. From the turbines (centrifugals), which are the last stage of the whole sugar making process, the sugar is allowed to cool in large wooden compartments or cases for an hour or more and then bagged first in an inner "gunny" bag (jute), imported from India, and then an outer bag made of the dry leaf of the "vacoa" palm (pandanus), grown on most of the estates, the total weight of a full bag being as a rule 75 kilos or 165 lbs.; the lower jets, or the syrup sugars—2nd, 3rd, 4th, and sometimes 5th "syrups"—are bagged in double vacoa bags.

With the system of machinery the Mauritius planter possesses to-day, he makes bold to claim a place in the first rank of sugar-makers in the world; were he not hampered and handicapped by the numerous and great difficulties he has to contend with, he would be able to do even still more by means of other perfected machinery such as is to be found in the sugar factories of Europe and Egypt, which I can confidently say more prosperous times would have enabled him to possess, and thus to compete with a certain amount of success against any beet or cane sugar factory in the world. The spirit of energy and enterprise with which the Mauritius planter is endowed bears him up with courage in trying new improved methods of work whenever he

is able to do so. I might here cite the case of the diffusion process which is so successful in Egypt, and which was tried with the financial support of the local government on Britannia Estate in the southern district of the island, a very costly process as regards the fitting up of the machinery and especially so in the items of fuel and labour, which turned out to be the stumbling-blocks. As long as the sugar maker is not able to get coal at Rs. 8 the ton delivered at his door, instead of Rs. 20 or Rs. 30 at the railway station, or such a supply of cane as would keep his usine working continuously, so as to produce a total crop of 6 or 8 million lbs. of sugar (4,000 tons) at least, diffusion in Mauritius will only lead to greater confusion. For the above reasons (cost of fuel and labour) and an insufficient supply of cane, "Britannia" had to go back to the rollers. Another estate, "Mon Rocher," in the northern district, also tried the new process, but failed for the above and other reasons.

It is difficult to say exactly what is the maximum quantity of crystallisable sugar in the cane (apart from the "invert" sugar) which the Mauritius planter has been able to extract from his canes hitherto. I do not think I should be far wrong in saying that 12% of the crystallisable and 0·5% of the "invert" have been obtained, as a maximum, from presumably ripe canes. In order to find out the exact percentage of sugar, the planter would need to weigh his entire crop of cane (the whole quantity of cane carted to the factory), a rather difficult and somewhat impracticable thing to do in the hurry of work at crop time.

The main difficulty which the planter has to face at the present day is the low market price which his sugars fetch and have been fetching these last five or six years. In Mauritius generally one "arpent" (a little more than one acre) of land, after preparing it for planting, and after cultivating the cane, cutting and carting same to the factory, costs about Rs. 400, that is, one acre of virgin cane—which should yield 2½ tons (5,000 lbs.) of sugar at least—in order to get a profit on the sale of this crop of sugar, must fetch more than Rs. 8 per 100 lbs., as an average. Last year's crop did not, to my knowledge, fetch more than Rs. 7·80 to Rs. 7·90 on the average in more instances than one. Therefore the Mauritius planters are now doing their utmost to produce sugar at as low a cost as possible, many doing their best to produce at Rs. 6 cwt. (110 lbs. or 60 kilos.), which, if they succeed, will enable them to get a net profit of one rupee per 110 lbs. on Rs. 7,

which to all appearances seems to be the average figure for this year's crop. What with the varied claims which nine-tenths of the planters have to meet in the shape of interest on mortgages, payments of outstanding bills, apart from the heavy items of the budget, such as monthly wages of labourers, guano, rice and grain, mules and oxen, and above all, having to battle against that hydra-headed monster, the bounty system, which is enabling the French, German, and Austrian beet sugars to overwhelm the markets of India and Europe, they (the Mauritius planters) are apt to lose heart and fear that they and their families will end their days in wretched misery, unless a gracious helping hand is extended to them from the home and Indian Governments in some form or other, so as to encourage and facilitate the introduction of their cane sugar in the United Kingdom and the British Colonies, where the Mauritius planter looks in vain for the "open door," that door being blocked by the bounty-fed monster. A ray of hope is, however, beginning to show itself through the dark cloud; the mercantile community in Bombay and Calcutta is, we learn, taking the subject into consideration, and the official authorities will no doubt study the question in an efficient and decisive manner. It is no fallacy to state that the so-much-to-be-desired question of the protection of Mauritius sugars imported into India ought naturally to engage the serious attention of the Indian Government, mainly because of the important and all-absorbing fact that two-thirds of the inhabitants of Mauritius are Indians, and that the prosperity of the island, which hinges entirely on the sugar industry, is a question of life and death to them, as much as to the other elements of the population.

By the following comparative statement of the exports of sugar, it will be seen that India heads the list; Cape Colony comes next, while, Australia, which was far ahead of those two countries in 1862, occupied the third place in 1896. Exported to India in 1862-63 (the first of exportation to that country) tons 8,275, in 1895-96, tons 48,630; to Cape Colony, 1862-63, tons 6,908, 1895-96, tons 16,828; to Australia, 1862-63, tons 34,958, 1895-96, tons 13,270. The first exportation of importance made to the Cape and Australia was in 1847-48, when the Cape took 4,286 tons and Australia 5,159 tons.

The above figures are in round numbers, as well as the following comparative statement of the sugar crops (exportations) of the last decade.

	Tons.		Tons.
1886-87	102,376	1891-92	124,759
1887-88	124,073	1892-93	94,097*
1888-89	132,172	1893-94	87,408*
1889-90	124,564	1894-95	139,489
1890-91	129,443	1895-96	117,430

an average of about 118,000 tons per annum, reckoning 1,000 kilos to the ton.

The above is an extract from Garrioch's Mauritius Almanac, 1889 and 1898, also the following :—

The largest value in rupees of the above crops is that of 1895-96, viz., Rs. 29,855,640. The smallest is that of the cyclone crop of 1892-93, viz., Rs. 15,346,233.

The present crop (1898-99) promises to be the best on record for many years past, being estimated at more than 150,000 tons.

Mauritius has now become, I venture to say, a small paradise to the large coolie element introduced into the country as agricultural labourers from the three Presidencies of the Indian Empire since 1835. The coolie labourer, after his first five years of indentured service, is free to renew his contract of service with his employer for a year or two more, or to return to India, or to be a gentleman at large. I am happy to state that three-fourths renew their contracts with their former employer or with a new one on some other estate, and after continuing this mode of life for a certain number of years they become landed proprietors—cane planters supplying the factory in the neighbourhood with their annual crops at a small profit on their expenses for planting, which are next to nothing, and thus contribute in a measure to the prosperity of the Island. The Mauritius planter is not so blind as to see that he owes a great deal to these Indians, who are as a rule a fine race of men, intelligent, hard-working and thrifty, hence it is his object to do his utmost in making them as happy as he possibly can. One rejoices to find on some estates two and sometimes three generations of the same Indian family.

The question of coolie labour has been a very vexed one with several of our Governors; one, whose name I cannot overlook in this paper, and one who has always had the interest of the planter as well as that of the labourer at heart, is Sir Arthur Gordon, now Lord Stanmore, who "took the bull by the horns" and inaugurated an era of contentment and happiness for our Indians, which has resulted in a

* Consequences of the great cyclone.

more cordial *entente* between labourer and planter than ever before. Sir Arthur bequeathed to his successor, Sir Arthur Phayre, the difficult task of passing and enacting the new Labour law, which, however seemingly vexatious and annoying to the planter at first, has now become a covenant of mutual goodwill between employee and employer.

Another evidence of the material welfare of our Indians is that more than one, after fifteen or twenty years' residence in the Island, have had to their credit in the Government Savings Bank over and above Rs20,000, and more than one are now planters and owners of sugar estates.

With its large Indian population and other elements of various races, Mauritius, that gem of the Indian Ocean, although an insig- significant jewel in Queen Victoria's crown, shines with as bright a lustre of loyalty and devotedness to Her Majesty's person as any larger diamond in our beloved monarch's diadem. The Mauritians cannot and will never give up the hope and confidence they have in their Most Gracious Sovereign's affection for her loyal subjects in their time of trouble, however remote they may be from the footstool of her throne.

A correspondent of the *Louisiana Planter* says that American capitalists seem to be directing their attention in Cuba rather to tobacco than sugar, and draws the conclusion that they think sugar manufacturing is no longer a paying business owing to the sharp competition from all parts of the world.

The "Repertorium" of the *Chemiker Zeitung* consists of a number of abstracts of articles that have appeared in the various chemical and technical publications of Europe and America. In one of these abstracts, from an article on Grossé's Process published by the *Sucrerie Indigène*, the reviewer, whom we believe to be a thoroughly practical and well known technical scientist, remarks: "According to these statements, the most material point in this process also is that there should be sufficient boiling accommodation to be able to boil thoroughly and slowly, which in the case of inferior products is the necessary condition of any success. It is self-evident that a vacuum pan is too expensive an arrangement to serve merely as a stirring apparatus during cooling down."

ON THE COMPOSITION OF CERTAIN RAW SUGARS AND PRODUCTS OF REFINING.

(Concluded from page 141.)

In the year V. the proportion (V.) remained the same in the refined masse-cuite as in the raw sugar; in the years VI. to VIII., on the contrary, it fell off in an increasing ratio; note, for example, that in the year I., 1·84 of the raw sugar becomes 1·11 in the refined masse-cuite, while in VII. 1·31 becomes 2·02, and in VIII. 1·25 becomes 1·90. Recently, even increases in the ratio of 1 to 3,5 or of 1 to 4 are no longer extraordinary. For instance, refined masse-cuites occur which contain 0·24 % organic matter to 0·06 % of ash. All these observations prove clearly the fact, by no means new, but constantly insufficiently appreciated, that the absolute quantity of non-sugar, particularly the organic portion, is by itself not sufficient to go upon, but that all depends on its quality. It is just the most prejudicial and damaging kinds of non-sugar (pectine matters, pentosan, dextran) that adhere most obstinately to the sugar, they retard and render more difficult the washing to an extraordinary extent (during centrifugalling as well as during washing out) and also cause, as, for instance, in the further working of the refined masse-cuite into refined sugar, a retardation of the clearing and an increased consumption of clearing liquor; in some cases certain residues of these substances cannot be removed at all from the masse-cuite, and it was then evident from the observations made in different refineries that the second masse-cuite, obtained from the green syrup by boiling, is far more easily and quickly obtained pure than the first masse-cuite! The principal cause of the deterioration of V., as is especially noticeable in the case of the year VI., can hardly be looked for in anything else than in the increasing re-introduction of runnings and syrups into the juice, which, as I already explained a few years ago, must necessarily occasion a steady accumulation of the most injurious of the non-sugars, viz., those which cannot be removed by the usual processes of purification. The inventors of these methods of re-introduction dispute this, it is true—at least each as regards his own process. The practical experiences of all refineries, however, prove the correctness of my assertion, while the chemical investigations speak likewise in favour of it.

The proportions in the washed syrup (column 3) are naturally in the inverse ratio to those of the washed sugar, *i.e.*, V. falls in the former (in contrast to V. of the raw sugar) when it rises in the washed sugar and so on. V. is approximately the same for the green syrup from the refined (column 4). As for the refined sugar masse-cuite, whether small differences in the (average) figures tend to show that organic matters remain in this masse-cuite or are due only to experimental errors remains undecided. The same remarks apply to the second masse-cuite (column 5), which is boiled from this green syrup, and one feels inclined to explain the falling of V. in some cases by decomposition of organic matters.

The green syrup from the second masse-cuite shows, as might be expected, no considerable variation in the V. (column 6). The white sugar masse-cuite presents the same phenomenon, but a gradual increase in the V., due to repeated boiling and the decomposition caused thereby, now begins to be more clearly noticeable.

The second sugar (column 8) was in the first five years white sugar only, but in the three last years was also partly raw sugar. The V. is always more favourable in this case than in that of the original raw sugar (column 1), which means that proportionally more organic substance passes over into the green syrup than into crystals forming. Hence, in the green syrup of the white sugar masse-cuite (column 9) the V. is in most cases essentially higher than in the masse-cuite itself, and, considering the great concentration of the organic non-sugar in this product, its easy transference into the green syrup is somewhat remarkable.

In the raw sugar masse-cuite (column 10) this green syrup (column 9) is mixed with the washed syrup (column 3). The comparison of these two components shows that in the first and second years the V. for the green syrup was +0·09 and +0·27 units respectively better than for the washed syrup. In the following years, however, it was worse, namely in IV. (when the raw sugar showed the abnormal figure V.=2·30)—0·92; in IV. to VI. —0·52, —0·14, and —0·32; in VII. —1·01, and in VIII. —1·04. The change for the worse in the quality of the non-sugar through the re-introduction of the runnings is again easily recognisable from these figures, they confirm the view that we no longer succeed as formerly in correspondingly improving the V. of the washed sugar, *i.e.*, in at once transferring the organic constituents of the raw sugar, in the

same degree as the ash, into the washed syrup. Inasmuch as in the masse-cuite III. (raw sugar masse-cuite) is accumulated all the non-sugar contained in the original raw sugar, and as the fresh non-sugar formed by unavoidable decomposition is further added to the other, it is to be expected that the V. will be somewhat higher than in the original raw sugar, and this is the case all through; in the years VII. and VIII. the increase is indeed very striking.

In the raw sugar of the third jet (column 11) the V. is again almost as high as in the original raw sugar (column 1). In the years I., II., and VI., the V. of this sugar and of the masse-cuite of the third jet are almost identical. The ash and organic matters have therefore distributed themselves uniformly; in the years III., IV. and V. a small improvement has taken place in the V. between the masse-cuite of the third jet and the third sugar, whilst in VII. and VIII. a considerable improvement is noticeable.

In the after-product masse-cuite (masse-cuite of the 4th jet, (column 12), the proportions are of a similar character, and the V. has, as a rule, somewhat increased, as compared with that of masse-cuite of the fourth jet.

A very remarkable phenomenon is now observable in the case of the sugar of the fourth jet (after-product, column 13). Apart from a small difference in the year VIII., this sugar presents in all these years a much more favourable V. than the original raw sugar (column 1) and than the preceding sugar of the third jet (column 11). In the years VI. and VII. the V. of the fourth sugar is even more favourable than that of the second sugar (column 8), the ash preponderating over the organic matters, and the V. becoming less than I. During the crystallization of the after-product masse-cuite, proportionally more ash than organic matters has passed into the crystals, which is contrary to all ordinary expectation, and almost indicates that as soon as a certain concentration of the non-sugar is reached, it is no longer a question of the mechanical enclosure of deteriorated mother-liquor in the crystals, but of a mutual crystallization of sugar and salts, *i.e.*, the crystallization of compounds of sugar with ash constituents and salts.

Observations in any one single factory naturally do not warrant us in drawing general conclusions; they are, however, at all events, calculated to stimulate a closer study of analogous conditions in other factories.

The molasses (column 14) contain primarily all the non-sugar of the raw sugar, and in addition all the non-volatile products of decomposition formed during the working. The V. is therefore greater than in the case of the raw sugar by the following amounts: 0·13, 0·22, 0·19, 0·23, 0·31, 0·20, 0·58, 0·60. The high figures of the years VII. and VIII. again show the disadvantage of the re-introduction of the runnings, for the unusually bad proportion between the V. of the washed sugar and that of the raw sugar indicates that correspondingly more and more organic substances of an injurious nature remained in the washed sugar, passed over into the real refining process and caused, or brought about, favourable conditions for the decomposition and destruction of sugar. The repeated reference to the re-introduction of the runnings, and of its evil consequence, may perhaps to many readers appear superfluous, but in fact it is really not so, so long as the assertion—contradictory alike to arithmetic, experience, and logic—that a good masse-cuite is not deteriorated by the addition of a qualitatively inferior one, but indeed may be possibly improved thereby, is still constantly brought forward and still finds fresh believers, although—a true satire upon our otherwise rightly much lauded German accuracy—it cannot be based upon even the shadow of a serious proof.

The figures above quoted, and the remarks based upon them, which could easily be extended much further, show at all events that there are, even in the simplest and longest known processes of our industry, still many things hitherto disregarded and unexplained, and that there is plenty of scope for remunerative research. Progress can be attained (as Schopenhauer says), as in many other quarters so also in the one before us, not only by discovering that which is new, but also by regarding that which is old, and from a point of view different from that hitherto adopted.

With regard to the re-introduction of the green syrups into the working, a reviewer in the "Chemische Repertorium" of the *Chemiker-Zeitung*, says, apropos of the statement by Winchenbach in the *Deutsche Zuckerindustrie* that this operation can only be successful in the case of well clarified syrups of high purity:—"It is a truly extraordinary supposition that people should go to the trouble of obtaining syrups of a high degree of purity merely for the purpose of afterwards boiling them up with added impure green syrups."

IMPROVEMENTS IN TROPICAL AGRICULTURE.

A Paper read by Mr. HART, F.L.S., of Trinidad, before the Agricultural Conference at Barbados.

(Continued from page 156.)

Work in the same direction has since been carried on in both Demerara and Trinidad, and from a comparison of results it is seen that there is every hope that canes will soon be on hand which will drive out of cultivation, by fair competition, the favourite old kinds so dear to the heart of the planter. There is also direct evidence that the time will not be long deferred, for in the report of the planters to the Trinidad Agricultural Society of the results of the 1898 crop from the new canes, the following occurred:—Eleven varieties ground together "gave an average weight of 77 tons to the acre, and the specific gravity of the juice was 10·78." As time goes on probably more definite and favourable reports will be forthcoming.

We have a distinct advantage in carrying on our efforts at improvement, for we start with all the previous experience of the beetroot raisers to guide us. As to the time it will take to reach the goal, though it must of necessity be long, yet it will in all probability not be nearly so long as it took for the improvement of the beetroot, even in the last stages of the process.

It will have been observed in the various reports, that the method of procedure with the cane is the exact counterpart of that used for the improvement of the beet, namely, seminal selection and chemical examination combined.

It has been suggested in Trinidad some years ago, in Louisiana, and elsewhere, that some improvement might be effected by selecting the sweetest canes from certain stools, and raising successive generations therefrom. The weak point in this suggestion is the fact that the stool must be taken as one individual, and its value must be taken as a whole, and not in part, for the parts vary, but the stool varies less. A low sugar-content cane taken from a stool might give a high sugar-content when grown and well ripened, and *vice versa*, for it is a fact that in all kinds of cane, no matter of what character or class, some canes in each stool will be found sweeter than others. This is mainly due to their state of maturity, together with the state of the

atmospheric conditions prevailing at the time of selection, but more to the former than to the latter, although the general value of the stool is largely influenced by the state of the weather. The riper a cane and the less water it contains, the sweeter it is per cent., but whether it would maintain its sweetness the ensuing season would entirely depend upon the state of maturity it then attained and the conditions of the weather, which might hinder or debar it from attaining that maturity. The value of a cane, therefore, depends upon the general average of a stool, and the principle of selection according to the chemically ascertained "general average of a stool," is certainly a better method of progression from all points of view than the selection of individually sweet canes.

In carrying on such work, however, every point which can be advanced deserves the fullest investigation, for no detail is too small, or too insignificant to be neglected. Prove all, prove everything, by scientific proof, and then if they stand the test or fail, we know whether we are progressing, have upset or confirmed a theory, or have made no way whatever.

Seminal selection must be put in the first place in our work of improvement, for it is certain that we must have the plant before we can give it improved cultivation. It is not intended to discuss at this time the improvement which can be effected by properly directed cultivation and manuring, as that is outside of our present subject, and the methods of cultivation and manuring are quite sufficient in themselves to form the subject of lengthy papers. It has been shown how important it is that the work of directing experiments in the raising and trial of new canes should be well carried out; but it must also be shown how necessary it is that such experiments should be carried on continuously at several centres. It is not sufficient that they should be carried out at a single centre, for the simple reason that individual choice and fancy has a great deal to do with the results which will be attained. Every new cane has to pass in the first instance a field test or choice, *i.e.*, the cultivator must judge whether or no it possesses those characters which would enable it to be economically grown for the production of sugar, and in making this selection, every cultivator would have his fancy, or his idea, of what a good cane should be like. One cultivator might condemn what another would save, and therefore the chances would be that a greater variety of canes would be secured by having several stations, than would be the case if a similar number were grown at a single

large station. Again, a cane might prove a very useful variety in one colony, but prove utterly useless in another. There is a well-known case in point in the "Burke" cane, which is quite useless on Trinidad soils, and, *vice-versâ*, a cane raised in Trinidad might not suit at all the drier climate of the more northern islands.

Again, the choice of an individual experimenter might fall upon a certain habit, quite suitable for where he is stationed, but useless elsewhere. It is clear, therefore, that the number of observers is a point in favour of a successful issue, for the larger the number, the more likelihood there is of securing a series of useful kinds, provided the procedure is based on similar lines.

NATAL SUGAR INDUSTRY.

THE NATAL ESTATES REFINERY.

The following extracts from a report of a visitor to this new refinery, the only one as yet existing in Natal, will be found instructive, and it is very satisfactory to hear of the progress which is being made in that favoured colony, which has a great future before it as regards the sugar industry, unless the careful policy hitherto pursued should be nullified by visionary and unpractical legislation.

The capital required for the erection of the refinery—some £50,000 having been spent altogether upon the concern—was found in England on the formation of the Natal Estates, Ltd., some three years ago, when the estates belonging to the Natal Central Sugar Company were taken over by the new company, the local directors of which are Messrs. M. Campbell, D. Don, G. Payne, F. Reynolds, and R. H. Wisely. The raw material for the refinery is supplied chiefly by the Mount Edgecombe Factory, but it is also obtained from almost all the other Natal factories. As regards the dimensions of the premises, the main block, standing 50ft. high, has a frontage of 150ft. and a depth of 85ft. Of the several other buildings of scarcely less importance, the largest are the store in which the sugar is stocked, with workshops under the same roof—130ft. long by 30ft. wide; the general store, 100ft. long and 46ft. wide; and the manager's office, counting house, and laboratory, 70ft. long. Within a stone's throw of these premises are the Manager's (Mr. John L. Malcolm) neat residence, eleven cottages for European assistants in the various departments, and a location for nearly 200 Indians (men,

women, and children). The coolies, under the Sirdar, are engaged in different classes of suitable work, the men at the heavy tasks and the women and children making and filling sugar bags and treacle tins, at which some of them have now become expert, not, however, without much painstaking instruction from the manager, and the experienced employees under him, mostly drawn, like himself, from Greenock sugar refineries.

The plant was supplied by the large Glasgow Engineering firm of D. Stewart and Co., Ltd., to whom the Natal Estates entrusted the contract for the whole of the refinery machinery and massive iron material of the building as it stands. The eight engines, machinery, and plant cover pretty well all the floors, which rest upon cross girders and massive iron pillars bearing up from concrete foundations buried deep below the surface. Mr. John Stanley, of Verulam, put up the brick and concrete building. When all was ready, or nearly ready, Mr. Malcolm—who, by the way, had previously been nineteen years with the Glebe Sugar Company,—came out last October twelve months, to make good the contractors' guaranteed producing power of the plant. When that was realised, and over £50,000 had been spent by the Company upon the concern, he accepted their offer to become the manager. The refinery was informally opened in December, 1897. The first lot of raw sugar came from Mount Edgecombe, the quality of the refined product being analysed up to 99·96 per cent., and it should be mentioned that this quality (which has varied but little since) was equal to any of the home sugars, and was, in fact, a great deal better than most of those imported into the colony. The laboratory is furnished with all the necessary chemicals and scientific paraphernalia, the latter including a minutely-balanced pair of scales capable of turning with the weight of one thousandth part of a gramme, the polariscope being located in a separate dark room.

The various processes may be described as follows: When the raw material arrives by the rails at the refinery door, every pocket is weighed, twenty at a time, a sample of the lot is taken for analysis, and a proper quantity apportioned for melting. From a large receiver on the ground floor, into which the bags are emptied, the coarse brown grain is carried up to the top floor by an elevator, and goes straightway to the melting pots, or, as they are technically termed, the "blow-ups," in which the contents are not only reduced to a liquor of 50 per cent. solution, but heated by steam injections

until a temperature of from 160° to 180° Fahr. is attained. The melted sugar is run off into what is called a Taylor filter, where any suspended matter is extracted, and a clear brown liquor comes away to a receiving tank. This tank is connected with animal charcoal filters. On the premises there are about 200 tons of burnt bone charcoal, which may be used over and over again for five years, when thoroughly cleansed by water and by fire in retorts forced up to a great heat. The filters in which the charcoal is used are cast-iron cylinders, 22 feet deep, with perforated false bottoms, covered with a blanket. The charcoal is filled right up to the top, and equally distributed during the filling by the workmen. The sugar liquor is turned on, and it slowly percolates down through the 22 feet of charcoal. When delivered, it is of beautifully clear and crystalline appearance, the charcoal having absorbed every particle of colouring matter. The charcoal is carefully tested by chemical means before being used again. The liquor runs through long gutters to other receiving tanks, and thence on to two vacuum pans. The word "pans" is somewhat deceptive as to the size and capacity of the vessels, as they are capable of treating from 25 to 30 tons per day. The vacuum is obtained by large pumps with condensers attached. The boiling liquid sugar is tested by means of a "proof stick," and when it has arrived at the proper consistency it is delivered to three malaxeurs—the most modern invention to be seen in any refinery in existence. The treatment of the sugar here is similar to that in the vacuum pans. The product then finds its way into six centrifugal machines, running at a speed of from 1,600 to 2,000 revolutions per minute. In this way the drying begins, and on being deposited in barrows the sugar again goes up to the top floor, in a hoist capable of raising a ton, and is distributed by means of shoots. On one of the drying floors there is a cube-sugar machine. Among the Natal Estates exhibits at Grahamstown are a number of white sugar loaves in the familiar conical shape, specially cast at the refinery; but as this form of loaf sugar is not inquired after so much as it used to be, it is not made by the Company unless asked for, as their cube machine turns out the article ready for the cup, and cut at the rate of five tons per day. This has been judged by competent men to be equal to anything of the kind imported, and it is packed on the premises in cardboard boxes of 1lb., 2lb., and 5lb. weight, and some of it in 50lb. cases. On the same floor is a granulator—a huge revolving cylinder filled with hot air for completing the drying process

of the soft sugar, and making it fit for packing. The weight of the bags, when filled, is 5lbs. and 10lbs., and they are packed into cases of 50lbs. each.

In the production of syrup, the last, but by no means least interesting portion of the process, the melted sugar is run into wooden vats lined with lead, and afterwards filtered through charcoal, as before described. It is then boiled in a copper vacuum pan, and repeatedly tested before attaining the proper consistency. Then it is run into refrigerators, and drawn off by valves into 2lb. or 4lb. tins or casks. The No. 1 quality of golden syrup also has a high reputation in comparison with the imported article. There are two qualities of golden syrup produced here, as well as refined treacle.

To drive all the machinery there are four multitubular boilers and eight engines, the largest, an almost silent and perfectly smooth-running horizontal motor of 50 h.p., working the vacuum and condensing pumps. Another engine charges the dynamo, and this supplies electricity to 120 incandescent lamps about the premises, but is capable of lighting 230 lamps.

For the busy workshops tin in sheets is imported from England; wood for the packing cases and casks comes from America and Norway. In the engineers' shop turning and every other kind of work required is done. For the large quantity of water required at the refinery the company have a contract with the Corporation, and a store is kept in a large reservoir sunk quite close to the 110ft. chimney-stack, with which the boiler flues are connected. The company have also in contemplation a supply of the bulk of the water required, specially for condensing purposes, from the Umbilo or the Umhlatazan Rivers, to both of which access has been secured in case of need.

ANALYSIS OF REFINERY PRODUCTS.

Government Laboratory,

Durban, August 22, 1898.

Report on two samples of sugar received from the Natal Estates, Ltd., Durban:—

	Sample A. Per cent.		Sample B. Per cent.
Sucrose	99·903	..	99·697
Glucose	0·048	..	0.084
Moisture	0·033	..	0·069
Ash	0·016	..	0·052

Sample A is a pure white crystalline sugar of the highest quality, containing over 99·9 per cent. of pure crystallised cane sugar, with a mere trace of glucose and moisture, and the merest trace of ash (potassium and calcium carbonates). It is pure in colour and brilliant in lustre.

Sample B is likewise a pure white sugar of high quality, containing 99·7 per cent. of pure crystallised cane sugar. It has not been drained with the same care as Sample A, as it contains about twice the amount of glucose, giving it a faint yellow-tinged colour, and consequently retains more moisture and ash, though the absolute amount of each is still small, scarcely a twentieth of a per cent.

No trace of any impurity could be found in either sample, beyond the small quantity of natural ash, and both were well suited for any industrial use.—(Signed) E. Nevill, F.T.C., F.C.S., &c., Government Chemist, Natal.

THE INDIAN SUGAR INDUSTRY.

In a circular issued by the Director of Land Records and Agriculture, Bengal, dated Calcutta the 11th January, 1899, the Sugar Imports into India for 1897-98 are stated to have been:—

	Tons.
From Austria-Hungary	47,217
,, Germany	60,165
	107,452

representing a value of Rs. 332,33,028, or at 1s. 4d., £1,548,868.

A five per cent. import duty on this, amounting to Rs. 11,61,654, or £77,443, is a direct gain to the Government.

The bounty paid by the two above-named countries, taken in a round figure at 25s. per ton, comes to Rs. 20,14,725, or £134,315, which is an indirect benefit bestowed by the government on the well-to-do classes by the admission of Austro-German Sugar.

In all, the country gains Rs. 31,76,379, or £211,758.

40 tons of refined sugar require 100 tons of raw sugar.

107,452 tons of imported sugar, if to be manufactured in India, would use up 268,630 tons of raw sugar; of this quantity the Indian cultivator has been deprived in 1897-98.

One acre may be taken at one and a fifth Behar biggah, the latter gives about 30 maunds of raw sugar. The area from which 268,630 tons of raw sugar could have been obtained would be 201,473 acres, and the profit to the cultivator, that is, the poorer class of natives, taken at Rs. 50, or £3 6s. 8d. per biggah, would have amounted to Rs. 120,88,380, or £805,892.

If judicious and timely administration had prevented the import of beet in 1897-98, and if Indian refined sugar had been used, the country would have lost Rs. 31,76,379, or £211,758, but gained Rs. 120,88,380, or £805,892, and would therefore have been Rs. 89,12,001, or £594,133 to the good.

For every five seer bag (10 lbs.) of refined beet sugar the Indian consumer buys, he adds 9 pies ($\frac{3}{4}$d.) to the Government Revenue and obtains a present from Germany of 17 pies ($1\frac{1}{4}$d.), on the other hand he deprives his poorer brethren of 74 pies, or over six annas (6d).

The total area under cane in 1896-97 was 2,651,721 acres; on this the 201,475 acres mentioned above are an increase of 13% being 316 square miles or a square measuring $17\frac{3}{4}$ miles in length and $17\frac{3}{4}$ miles in width. It would mean, in other words, that to have grown the amount of cane producing 268,650 tons of raw sugar, a strip of land $8\frac{1}{2}$ feet in width would have had to be added on one side of each acre. Some cynics think India incapable of this.

Improved machinery is often talked of as wanting, by people who are ignorant of the fact, that some of the modern refineries in India have the very latest English, American and German appliances and are therefore prepared to meet refined beet on an even footing, but they find it most difficult to compete with it when handicapped as at present.

Given fair competition, cane sugar has in India a better chance than beet, and by encouraging its manufacture Government would nor only improve the status of the poor, but would revive one of the greatest manufactures of the country which is now fast dying out.

"Fair Play."

The sugar industry is making progress in Portuguese East Africa. There are two factories near Chinde (at the mouth of the Zambesi) and one at Lourenço Marquez.

GOLDEN SYRUP.

By Sigmund Stein,

Manager, Crosfield, Barrow & Co., Sugar Refiners, Liverpool.

The Grocer, of 10th December, 1898, announced that at the Southwark Police Court, Mr. Walter E. Beardsell, of Jamaica Road, Bermondsey, London, had been summoned for selling golden syrup which was adulterated. The public analyst said the sample contained "40 per cent. of dextrine, 38 per cent. of dextrose and 22 per cent. of water." There was little cane sugar. It was a starch sugar or glucose syrup, whereas proper golden syrup was made from cane sugar. The magistrate imposed a fine of £2, with 12s. 6d. costs.

The Daily Graphic, of 23rd December, 1898, stated that Mr. C. J. Griffin, of Spa Road, Bermondsey, London, had been summoned at Southwark, at the instance of the Vestry of Bermondsey, for selling, to the prejudice of the purchaser, golden syrup which was not of the nature, substance and quality of the article "demanded by the purchaser." A tin of golden syrup was asked for at the defendant's shop by the chief sanitary inspector, and he was served with a syrup which, upon analysis, proved to be composed of glucose syrup 85 per cent, and cane sugar syrup 15 per cent. The Clerk to the Vestry submitted that golden syrup should contain at least 39 per cent. of cane sugar. The solicitor who appeared for the defendant said that "golden syrup" was only a fancy term, and had no legal significance. So long as it was composed mainly of sugar it mattered not whether that sugar was glucose or cane sugar, provided the purchasers were satisfied with it, which he could prove by the evidence of traders they were. It was a cheap and quite harmless substance, and the poor ought not to be debarred from buying it. The magistrate said that what the defendant sold the purchaser in this case was not considered golden syrup, because it did not contain sufficient cane sugar. It was not suggested that what he did sell was at all unwholesome, but the Act of Parliament said that one must sell what is asked for. He imposed a fine of £3, with 2s. costs.

A number of trade journals took the matter up at some length, and the questions relating to "golden syrup" have been thoroughly discussed by all firms interested in the syrup trade. These convictions may be said to have caused a revolution in the trade. Many sugges-

tions have been made as to how to settle the matter and protect the retail trade against further convictions.

The London Wholesale Sugar Dealers' Association called the attention of the firms interested to the advisability of putting an article on the market which could not be attacked, and which would correspond with the Food and Drug Act, remarking as follows:—

"You will see that the magistrate held that golden syrup "should consist only of cane sugar, and this was undoubtedly "its original meaning, as it was the finest form of syrup made. "The commoner qualities were called treacle and molasses. "Even in cases where tins are not marked 'golden syrup' a "similar question is bound sooner or later to arise where the "contents are treated with chemicals or even have glucose "added to them. It is possible not only to bring prosecutions "under the Sale of Food and Drugs Adulteration Act, but "under the Merchandise Marks Act, and we are advised that "under both these Acts prosecutions would lie against grocers "who sold tins of syrup containing ingredients other than "sugar."

Years ago golden syrup was in this country only and solely made from cane sugar, but lately a great deal of glucose has been used in the manufacture of golden syrup. The reason for this was to keep the syrup liquid and to prevent crystallisation.

This occurrence proves that it is absolutely necessary to have a proper definition of the term "golden syrup," and to fix standards to guide the trade so as to create a basis for legally determining adulterations of such syrups.

We have heard the opinion of one magistrate on this matter, and as it may be that other prosecutions may follow, other magistrates may either decide in the same way or may hold a diametrically opposite view. In any case it has been found necessary to adopt at once some provisional measure to protect the trade against further convictions until the matter should be settled eventually by a higher court. The grocers have protected themselves by putting a declaratory label on syrups containing glucose, because, as they state:—

"The addition of glucose to sugar in all probability brings "the mixture within the limits of the Adulteration Acts, how- "ever harmless, and, indeed, desirable the additions may be."

A mass of correspondence has appeared in different trade journals respecting the definition of glucose and of golden syrup. Unfortunately, there exists up to now no authoritative definition, not even by Somerset House.

In Webster's International Dictionary (1890) we find under "syrup": "2. A thick and viscid saccharine solution of superior quality, as sugar-house syrup or molasses, maple syrup."

The Dictionary of Arts, Manufactures, and Mines says: "Syrup is "a solution of sugar in water. Cane juice, concentrated to a density "of 1 to 300, forms a syrup, which does not ferment in the transport "home from the West Indies, and may be boiled and refined at one "step into superior sugar loaves with eminent advantage to the "planters, the refiners, and the revenue."

These definitions hardly bring us a step further, and I will, therefore, try to define golden syrup to the best of my knowledge and ability.

I would define "golden syrup" as the final uncrystallisable product of sugar refining, originally of cane sugar refining. It is a clear product of a golden colour, destined for table use. On the basis of this definition we cannot consider a syrup containing glucose as "golden syrup." By the latter term, "glucose," I mean the crystallised white product made from starch, which I would call "starch glucose," as opposed to the natural glucose (dextrose) in the sugar cane.

The yellow or golden colour of the "golden syrup" does not constitute the main characteristic of this syrup, which is, that it must be the unmixed and unadulterated last product of refining. This is the article the public want to get when demanding "golden syrup" from the grocer. But of late years most of the "table syrups" sold in this country have contained from 5 per cent. to 80 per cent. of added starch glucose. So general has the mixing of syrups with glucose become that a special trade has sprung up, that of the "syrup mixer," while starch glucose has been placed in the market as "41° Bé. Mixing Glucose."

The endeavour is made to justify the adding of glucose to syrups on the following grounds:—

1. Preventing the granulation (crystallisation) of the syrup.
2. Obtaining the yellow, pale, bright colour.
3. Covering the salt taste of beet molasses-syrups.

All these three arguments have done great harm, and their applications have made competition very difficult for the pure (unmixed) syrups, these being very often sold on sample, and to match these samples the syrup mixers helped themselves with starch glucose.

Starch glucose has no injurious effect on health and is manufactured with great precautions and according to the newest principles in America, but possesses an inferior sweetening power, and has no special taste; consequently, the adding of glucose reduces the practical value of the syrup in the proportion in which it is added.

The analyses of "golden syrup" vary very much one from the other, and I will give comparative tables of these later on.

The custom of mixing glucose with "golden" syrup dates from some 15 years ago, when glucose became very cheap, and this practice went on increasing from year to year, until it got so far that products containing 85% of glucose to 15% of syrup, were brought into the market as "golden syrup." These syrups had a very light and very bright appearance and competed with unadulterated cane sugar syrups.

It must be observed that the unadulterated pure "golden syrup" contains natural glucose. This natural glucose or uncrystallisable sugar, contained in the juice of the sugar cane, cannot of course be objected to, as it is a constituent part of the article in question. The delicious flavour of cane sugar "golden syrup" is due to the accumulation of this uncrystallisable sugar in the final product, and to the aromatic nature of the vegetable matters derived from the sugar cane.

It is a pity that the public taste demands a pale syrup without any regard to its origin or composition, as this demand for a light-coloured article has brought the use of glucose for mixing into vogue. But, I think the latest revelations in this matter will instruct the public as to the wholesomeness and nutritive value of pure cane "golden syrup," and lead them not to look so much to the colour as to the substance itself.

It must also be remarked that a great quantity of American glucose has been imported into the United Kingdom which has been of unsatisfactory quality, while this quantity of glucose, imported for the purpose of mixing, has displaced an equal quantity of pure cane "golden syrup."

(To be continued.)

THE FIELD FOR CHEMICAL IMPROVEMENT IN THE MANUFACTURE OF SUGAR.

By Wilfrid Skaife.

A paper read at a Meeting of the Franklin Institute.

I wish to lay before you, as far as the limits of this paper will admit, a general idea of the field which the sugar industry presents to the chemist and chemical engineer for original research. The paper is written from the practical sugar-makers' point of view, and deals with those problems which present themselves daily to us, and whose solution is of commercial as well as scientific importance. The pure chemistry of the various sugars is not touched upon, for, while the work to be done in this direction cannot be over-estimated, the field is too extensive.

To those who are familiar with practical sugar chemistry, it may seem that this field, in the present state of our knowledge, has been pretty well worked out, for no other industry has had more able chemists devote themselves to its study. From the time of Dubrunfaut, to whose wonderfully original mind we owe so much, a great number of good men have produced much good work. Robert, Scheibler, Stammer, Peligot, Berthelot, Casamajor, Maumené, Soxhlet, Biot, v. Lippmann, Wiley, Stohmann, Wiechmann, Prinsen Geerligs, Claassen and many others have built up a great literature of sugar. Through them our knowledge of the chemistry of sugar has been developed, and many great improvements in the extraction thereof, from the sugar-producing plants of the world, have resulted; but to indicate how little real advancement has been made for a long time, it may be pointed out that the latest and best beet sugar-house that has been erected this year, is constructed to use the method of clarification of the juice described by MM. Perier & Possoz in the *Comptes Rendus* of August, 1860, and modified later on by Jelinek, and that the latest refinery is using the same char-decolouration process, discovered by Derosne in 1812, and rendered practical by Dumont in 1828. The two great steps in the chemical treatment of sugar liquors—their clarification and decoloration—have remained the same, practically speaking, for forty and seventy years respectively. Both of these are laborious and expensive processes, and have been subject to steady attack by able men for a long time past, without being even shaken in their position. Other serious problems are still untouched or are the subject of controversy.

I wish now to say that I assume a general knowledge of the manufacturing and refining of sugar, on the part of the readers of this paper, and will, therefore, only indicate the various points at which the skill of the chemist may find a field for the search, without describing minutely the regular daily work.

It is an old German saying that "man haut den Zucker in die Rüben hinein," otherwise, that sugar is made in the fields. The function of the agricultural chemist, in relation to the sugar manufacturer, is one of primary importance, as the work of Maercker, Kuehn and Vilmorin, and a host of others can testify. The use of manures, scientifically, and the study of the diseases of the plant have greatly influenced not only the sugar content of the juice of the sugar-beet, but also the nature of the impurities contained therein; for instance, by the suppression, in a great measure, of the use of potash salts, and in some ways of nitrogen, and by the study notably of Dr. Kuehn, of Halle, of the nematodes, whose spread threatened to be as serious to the sugar-beet as the phylloxera to the vineyard. Perhaps to Vilmorin is due, more than to any other, the wonderful result of raising the sugar content of the beet from 8 per cent. to 22 per cent., a triumph of agricultural chemistry, and an indication of what may be done in this direction in the sugar-cane fields, where today no progress of practical value has been realized. The reasons for this are many; perhaps the greatest being the nature of the countries where the sugar-cane grows, but also, the nature of the plant itself, in that it produces only flowers that are not fertilized in a natural way, the propagation instead being caused by the sprouting of the joints underground. In consequence of this, the crossing of various kinds is nearly impossible, and we go on using the same unimproved plant and relying on empirical knowledge for the selection of the kind. I should state that here is the first and greatest field for the chemist—the study of the improvement of the cane and its economical manuring. Perhaps when the cane-sugar industry shall have such an establishment as we may see connected with the great seedsmen in Europe, where 3,000 or 4,000 polarizations are made in a day to select mother-beets, we may hope for some improvement in the cane fields. Cane has been raised from seed in Java, Demerara and elsewhere, but no practical results have come forth as yet.

Passing from the fields to the sugar-house, we have no chemical problem confronting us in the case of the sugar-cane, for in a well-organized plantation it is immediately ground up, bnt sugar-beets,

on the contrary, are stored in silos for several months, and a loss of crystalline sugar results, equal often to 2 per cent. on the weight of the beets, or over 10 per cent. of the total sugar in the juice. This loss occurs chiefly in the warmer countries where beet-sugar is made, and is severely felt, for instance, in some parts of France. It will naturally be caused by the sprouting of the beets in the silos, but also occurs apart from this; and to check it until the factory can slice up the whole crop, is a problem worthy of any chemist's skill.

To follow the sugar-beet, first, as it goes through the process of manufacture, the first chemical treatment which it undergoes is the extraction of the juice by means of diffusion. Mathieu de Dombasle, some seventy years ago, started the idea, and Robert, of Seelowitz, some thirty years afterwards, put into practical shape the process now universally in use, which, as you are all aware, is an imperfect osmosis, in which the uncut cell walls serve as the membrane and the broken cells discharge their whole content into the surrounding liquor. As handled to-day, the diffusion battery is a very excellent apparatus; the sugar content in the refuse being only about $\frac{1}{4}$ of 1 per cent. after an hour's contact with water, and the juice of a better quality is obtained more rapidly than in any other way. A great deal has been written concerning the handling of batteries, the question of temperature, etc., but still there remains one important matter from the manufacturers' point of view, and that is the dilution of the juice. Instead of obtaining juice of the same density as in the original beet, we have one containing 10 per cent. to 20 per cent. more water, which has to be evaporated later on at the expense of so much fuel. This dilution may be reduced either by raising the temperature of the battery, or by increasing the time of contact, but the former results in the extraction of a more impure juice, and the latter necessitates a much increased capacity. It is possible that a partial solution of the problem, at least, lies in acting on the slices by water under high pressure. It may certainly be assumed that if the process of dialysis is to be relied upon, all we can do to hasten matters is to provide for a more intimate contact between the cell wall and the water, for we cannot change the character of the cell wall without damage to its value as a membrane, nor can we use any liquid, except alcohol, which will cause the more rapid passage of the crystalline sugar, and needless to say, its use is not to be considered, on account of the expense.

The diffusion process, so successful in beet-sugar manufacture, has

found little application as yet in cane-sugar houses, principally on account of the dearness of fuel in the countries where cane-sugar grows. The grinding of the cane in mills produces a juice without dilution, or of a dilution that can be easily controlled, and is a purely mechanical operation, leaving a residue (bagasse) containing 7 per cent. of sugar, which supplies all the fuel needed for the production of the steam. It seems a wasteful business to burn sugar, but the reduction of the sugar content of the bagasse by pouring water on the mills is of doubtful value, inasmuch as a great many impurities are carried into the liquor along with the sugar, and an increase in the quantity of molasses produced is the main result.

Having now separated the juice from the fibre, the chemist's attention may be concentrated on the former, and he is confronted with an aqueous solution containing about 15 per cent. of crystalline sugar and 3 per cent. of organic and inorganic impurities, out of which he is to extract as much sugar in as pure and dry a form as possible, and for as little money as possible. Two means of solving this problem present themselves: He may rely on the natural tendency of the liquor to crystallize, and to help this proceed to clarify the juice and then evaporate it, or he may precipitate the sugar from its solution in combination with lime, strontianite, or baryta, and subsequently decompose the saccharate.

We know by experience that the first method is the one that is commercially valuable, and that the second one may be used on the final molasses only, after as much sugar as possible has been extracted by crystallization; the great bulk of the saccharate precipitate is the main difficulty in the way of this process, which is chemically very perfect.

The clarification of the juice is a matter on which the attention of chemists has been steadily concentrated now for forty years, without, as I have already said, materially altering the process of Perier and Possoz, who added an excess of caustic lime to the juice, allowed this to settle, thus producing a partial clarification, and then precipitated the greater part of the lime dissolved in the juice by carbonic acid gas. Later on, Jelinek pumped in the gas without waiting for the settling, and precipitated the whole mass together, precisely what we do to-day. The operation is repeated more than once now, and a very clean, clear filtrate is produced, with, however, a considerable expenditure in labour and machinery. It is a violent remedy considering the small amount of impurities we have to deal with, but

it is our only one. Its principal defects are the great quantity of lime needed (equal to 3 per cent. on the weight of the raw material), necessitating special limekilns and involving voluminous precipitates, whose separation from the filtrate needs pressure filters of great size and strength, and whose washing free from sugar means more water to evaporate.

The efforts that have been made to replace this clarification have been various in kind, and many in number, but only those which tend to produce a similar precipitation in the presence of the impurities with other reagents have had any success. Very beautiful liquors may be produced by the action, for instance, of lead acetate, of alumina, of soluble phosphates, of tannic acid, &c., but the practical sugar-maker has never been able to see wherein an improvement lay over the ancient carbonatation process. This process is generally described as an entanglement of the impurities in the falling calcium carbonate, but it may be looked upon as nothing more than a mechanical filtration of a very perfect kind, in which the filtering medium is moved through the liquor instead of the liquor being forced through a cloth, or whatever may be used. It is possible, that by bearing this in mind we may see our way to avoiding some of the troubles we are now afflicted with, and by performing a similar operation in such a way that a more intimate contact may be arrived at between the liquor and the falling carbonate, as good a result with less expenditure of material may be arrived at.

In cane sugar-houses the elaborate systems of clarification by carbonation and filtration have been tried and found wanting, for we find that by the action of a very small quantity of lime, and some heat, so great an effect is produced, that what would he gained by more perfect work from a purely chemical point of view would be lost commercially, owing to the extra time and apparatus needed. We are much nearer to the defecation problem in cane sugar than in beet sugar-houses. Some work which I have carried on for a couple of years in Cuba leads me to believe that a continuous and almost automatic clarification of cane juice, at a low temperature, may be brought about by extremely intimate mixtures of the lime and juice in exact quantities, but it would appear that the raw sweet juice is too refractory a material to yield to such simple treatment.

The chemist's mind has turned of course with some hope to electricity for the clarification of juice, and many and exhaustive have been the trials which have been made with this ghost-like element. Great

corporations have erected large plants to test the possibility of separating the impurities from the raw juice of the cane and the beet by electrolysis, with the result, as far as the general sugar public know, of demonstrating that while a great purification takes place it costs too much horse-power to effect it. These results, however, should not deter the chemist or electrician from further investigation, for it is quite possible that after the great mass of the impurities are removed, we may effect something by the application of the current to concentrated solutions?

In investigating the various methods of clarification, it has been customary to look to the removal of impurities as the standard of value. That is to say, the proportion of sugar to total solids dissolved in the juice is determined before and after clarification and the difference noted. This proportion, the coefficient of purity, as it is called, is the great guide of the sugar-maker for want of a better one. It is manifest, however, that when the *quality* of the impurities present is not considered, liquors of the same coefficient are not of the same value, and this leads to many errors in the treatment of the juice. Inasmuch as the object of removing impurities is to facilitate crystallization, we ought to attack those substances which give rise to a viscous or gummy condition of the liquor. All our efforts in fact should be directed to producing a medium in which the crystals may move with ease, and I may say, that for some time past I have abandoned tests for everything but viscosity, with extremely encouraging results.

The less viscous a liquor is the more perfectly will it filter, and the filtration of liquor is the most important part of its treatment. Could we take the raw juice from the cane or beet and filter it cold through a dense medium, I doubt whether any further clarification would be necessary, and in well-conducted sugar-houses the greatest care is now taken to produce liquors free from any suspended matter. Five or six different filtrations of the same liquor may now be seen in many beet sugar-houses, but I believe that the mechanical treatment of the juice is only beginning to be understood, and is destined to play a much more important part in sugar manufacturing as well as in other industries. We know now only the use of a filtering medium, through which a liquor passes under pressure leaving impurities on one side; we have yet to observe the action of masses of suspended matter in an extremely minute state of division and brought into contact with the liquor by mechanical means. Mechani-

cal filtration has already wrought one great change in the manufacture of raw sugar, that is, the total suppression of the use of bone charcoal and all its attendant cost and discomfort. Some refineries even are now working high-grade sugars without char, being enabled to produce a cold filtration of heavy liquor through the use of infusorial earth. The passage of this finely divided siliceous matter through the liquor effects the mechanical filtration which the cloths on the filter presses complete. I would strongly recommend the intending investigator to turn his attention towards ths production of a substance in the finest possible state of division, and to apply this to liquors which are to all appearances filtered already. In this work the microscope might be used to great advantage. It has yet to play its part in the examination of sugar liquors, and this part may be a mighty one.

I must now turn to the main work of the sugar-house, for which the clarification is a preparation, viz.: the crystallisation of the sugar out of its watery medium, and may pass over the reduction of the juice from its contents of 18 per cent. solids and 82 per cent. water to 50 per cent. solids and 50 per cent. water, inasmuch as this is an engineer's problem, and presents few chemical aspects of importance. The continuation however, of the evaporation in the vacuum pan, where the water is reduced to 5 or 6 per cent., presents a fine opportunity for the study of crystallization, a phenomenon of yearly increasing interest to the chemical world at large. The way the liquor behaves in the pan is the final test of the value of any method of clarification and a check on some methods of extraction. Over 80 per cent. of the total yield of sugar is obtained in this operation, and its proper carrying out is, therefore, of great importance. The study of the effect of high and low temperatures in the steam coils and in the body of the pan affords to-day a very excellent field for investigation. There occurs always in the boiling of the liquor in a vacuum a mysterious and considerable loss of sugar, caused probably, in part, by the action of the heat on the concentrated solution and by entrainment, or the flying of small globules of concentrated liquor upwards to the condenser. As regards the first, much uncertainty exists. As a rule, nowadays, steam at about 10 pounds pressure or less is used in the coils for economy's sake, but when time presses, boiler pressure is turned on, and while the amount of available heat is not much greater, the transfer is more rapid from the coil to the liquor. Whether we really lose more sugar with a high temperature

in the coils and rapid ebullition than we do at a lower temperature, when the liquor lies closer to the heating surface, is a matter with which the chemist can well employ himself. The excellent work of Dr. von Lippmann in this direction may serve as a basis for further investigation. While the question of entrainment is largely an engineer's problem, in which the velocity of the vapour is the principal factor, certain observarions made lately in Cuba have led me to believe that entrainment varies much with the nature of the liquor. There always occurs in boiling an entrainment of other matters than sugar, dissolved or suspended in the vapour, a sort of destructive distillation of the non-sugar, as it is called, and it would seem that this leads to the carrying up of crystalline sugar. Further, we do not know as yet whether the entrainment is affected by variations in the temperature and consequently the density of the escaping vapour, the velocity remaining constant.

When a strike of sugar is ready it consists of a mass of crystals, surrounded by a dense syrup, and may at once be centrifugalled, in which process between 60 and 70 per cent. of the weight of the masse-cuite is obtained in dry, raw sugar; or, it may be allowed to cool and crystallize further, in which case from 65 to 75 per cent. of sugar is recovered. A great deal of attention is now being paid to increasing this yield by stirring and cooling the masse-cuite simultaneously for several hours, and thereby promoting the growth of the crystals already formed. This would seem, on the surface, to be a very simple and logical process, but its carrying out requires much care, for there may easily be formed masses of minute crystals (technically known as false grain) whose presence is dreaded in the sugar-house, for either they retard greatly the work of the centrifugals or they involve a great loss by passing through the baskets with the molasses. At present the machinery in use is merely for a general agitation of the mass, but it has struck me that the directing of the flow of the mass in regular currents might greatly increase the regularity of the growth of the crystals. We have the well-known fact to start with, that if it gets a chance a crystal will grow at the expense of smaller crystals, and that a mutilated crystal, as observed by Wulf, will complete itself before other crystals are formed. The well-known work of Behr on crystalline glucose and, indeed, the daily practical experience at a vacuum pan seem to suggest that we may accomplish much by directing the path of the crystals in their journey through the mother-liquor.

After the greater part of the sugar has been centrifugalled out of the first masse-cuite we have to handle a molasses which contains about 20 per cent. of water and 50 to 100 per cent. of sugar in solution, the rest being inorganic and organic impurities. By evaporating some of the water—not too much—and either stirring the mass for a few days or letting it stand for a couple of weeks, a considerable quantity of second-grade sugar crystallizes out, leaving a lower grade of molasses. The simple thickening of this molasses the second time in the vacuum-pan will allow of still further crystallization, and whether this is done or more complicated means are resorted to, depends on the machinery at hand and the state of the market. The most successful chemical work of the last decade or two has been done in the treatment of the final molasses of beet sugar-houses. Cane sugar-houses produce molasses of a much lower content of crystallizing sugar and containing a large quantity of invert sugar, which are usually edible, while the presence of great quantities of calcium and potassium salts in the beet molasses renders them useless for food and difficult to handle in any way. By Dubrunfaut's osmosis process a quantity of these crystallizable salts may be removed and the sugar crystals allowed to form, or, by the various saccharate processes the sugar may be combined with the alkaline earths and precipitated from its solutions. These are very beautiful processes chemically. But in all of them, and particularly in the case of strontianite, a great deal of machinery is needed, and the low price of sugar is rendering their use very doubtful from the commercial standpoint. It seems strange that, given a material which, when evaporated to dryness, contains 50 per cent. of sugar, we cannot induce a crystallization without the expenditure of so much power. Very many attempts have been made to accomplish this by reintroducing the final molasses into the sugar-house, mixing it with the raw juice and carrying it right through to the end; but this must, after a time, produce a mother-liquor of impracticable bulk. The solution of the problem will perhaps come with a greater knowledge of the crystalline life (if I may use such a term) of an impure sugar solution, and how to mechanically assist the straining for union of the widely separated particles,

The limits of this paper do not admit of my dealing at any length with the main problem of the refining of raw sugar, which is its decoloration, and which we may say is produced entirely by the use of animal charcoal. In spite of hundreds of patents for other means,

the work of Derosne and Dumont has stood for seventy years or so, as I have already stated. Nobody has been able to produce artificially a means of exposing so advantageously the fine particles of carbon to the action of the liquor as the curious phosphatic skeleton of the bone affords us, allowing us, as it does, at the same time to collect so easily the carbon from the liquor after use and revivify it. There is perhaps no field of research which might repay the investigator better than that of the decolourizing of sugar-liquors, but anybody who undertakes this had better post himself thoroughly up in the literature of the subject, for many surprising laboratory results have been obtained already whose practical value is nil.

I may say, in conclusion, that whatever process a chemist may evolve for the improvement of the sugar industry must be subjected to the most severe practical tests before its adoption will be even considered by the manufacturers in general. All raw sugar-houses now work at very high pressure. They differ from other manufacturing establishments in that they are idle a great part of the year, and they must work at all speed for a few months to get through their perishable raw material. Even a few hours' stoppage may entail a serious loss, and therefore speed and smoothness are primary considerations in the working of any new process. I believe there is a case known of an irate planter, whose work was delayed by a new process, using dynamite one fine morning on the apparatus to clear the path for the resumption of his old system.

Further, the actual value in dollars and cents must be clearly set forth, or the discoverer must be satisfied with the scientific value of his work only. Sugar-makers are every day getting pretty circulars about how to get all the sugar out of the raw juice as first product, and similar impossible things, but business-like statements of income and expenditure are rare indeed.—*(Journal of the Franklin Institute.)*

GERMAN FACTORIES.

Results of 1897-98 Operations.

Most of these factories have now published their balance sheets for the campaign commenced in September, 1897, and we present our readers with a tabulated statement of the results, compiled from the details given by the *Deutsche Zuckerindustrie* and the *Centralblatt für die Zuckerindustrie der Welt.* The amounts (except in one instance which is indicated) are in marks, which are very slightly below the

English shilling in value. In reference to these figures we think it advisable to repeat the remarks which we made in our issue for October, 1896, as follows:—"In the case of some factories we have been compelled to abstain from giving results, as the available figures are not presented in a form which we can satisfactorily deal with. Of such are those where large portions of the ostensible profits have been handed over to the beet growers as *Nachzahlung* (supplementary payment), while the shareholders, excepting in so far as they were also beet growers, apparently got nothing. If the shareholders consist entirely of beet growers, as may possibly be the case, then it is only a question whether the first and second payments received constitute a remunerative profit or not, and this point we could not decide. Several factories devoted their profits entirely to writing off, in whole or part, the quota for depreciation and amortisation which they are legally compelled to do within a given period, or to clearing off partially or completely last year's debit balance."

Altogether, the correct comprehension and appreciation of these accounts is no easy task, even for experts, and we wish to guard against any supposition that the figures here given can in all cases be taken as quite accurate, in some they can only be approximately correct, but a fair average idea may be gained of the general result of the year's operations.

DIVIDENDS DECLARED.

Name of Factory.	Capital. Marks.	Per cent.	Name of Factory.	Capital. Marks.	Per cent.
Alt-Jauer	1,500,000	5	Lützen	1,200,000	5
Anklam	1,000,000	10	Mescherin	596,000	8
Barum	381,750	15	Munzel-Holtensen	258,900	5
Bauerwitz	655,200	4	Nauen	1,000,000	7
Bedburg	666,000	4⅚	Neuteich	600,000	5
Bennigsen	683,100	4	Offstein	750,000	10
Bernstadt	796,000	6	Opalenitza	1,200,000	10
Bredow	1,200,000	2	Pelplin	900,000	7
Ceres-Dirschau	600,000	6	Praust	750,000	2
Culmsee	1,300,000	20	Prosigk	351,000	20
Dirschau	450,000	10	Radegast	265,000	32*
Frankenthal	6,000,000	20	Rastenburg	740,000	7
Georgenburg (Union)	835,000	12	Salzwedel	900,000	4
Glauzig	4,500,000	6⅔	Sobbcwitz	591,000	4
Gross-Gerau	530,000	5	Stuttgart	1,320,000	5† 6‡ 9‡
Haynau	800,000	4	Tuczno	600,000	4¾
Heilbronn	1,660,700	6	Union b. Pakosch	835,000	12
Klein Wanzleben	2,700,000	8	Wetterau	835,200	2
Kruschwitz	2,508,000	14	Zduny	887,000	3
Kujawien	1,000,000	5			

* Last year 35⅔ per cent. † Ordinary shares. ‡ Preference shares (60,000 and 1,200,000 respectively).

N.B.—In several of the above cases considerable sums were carried to reserve fund.

NET PROFITS SHEWN.

Name of Factory.	Capital.	Profit.	Name of Factory.	Capital.	Profit.
Ahsted-Schellerten ..	495,000 ..	2,056	Königslütter	603,750 ..	178
Algermissen	450,000 ..	630	Kosten	917,500 ..	146,370
Altenau-Schöppenstedt	450,000 ..	1,570	Kreis-Jülich..........	800,000 ..	32,198
Altfelde	600,000 ..	1,580	Kreuzburg	600,000 ..	49,880
Ameln	700,000 ..	23,180	Lafferde	480,000 ..	24,150
Baddeckenstedt......	349,000 ..	2,360	Langenweddingen ..	256,500 ..	1,700
Badische (Waghäusel, &c.)	4,710,000 ..	39,337*	Lehrte	302,100 ..	970
Barth	800,000 ..	76,450	Liessau	479,400 ..	21,100**
Böblingen	1,085,714 ..	69,650	Linden	570,000 ..	811
Brakel	1,117,800 ..	17,880	Malchin	600,000 ..	73,680
Broitzem	220,500 ..	2,360	Markranstadt	450,000 ..	1,680
Brühl	1,050,000 ..	2,652	Mattierzoll	342,000 ..	101,130
Camburg	700,000 ..	10,013	Meine	594,500 ..	62,150
Cöthen	208,500 ..	4,800	Münsterberg	750,000 ..	3,840††
Dettum	300,000 ..	105,860	Neuhaldensleben	630,000 ..	16,700
Dinklar..............	297,600 ..	1,430	Neu-Schönsee	600,000 ..	205
Döbeln	690,000 ..	85,103	Neuwerk	1,500,000 ..	89,080‡‡
Eichthal	315,000 ..	85,938	Oberglogau	Fl.583,000 ..	2,760
Emmerthal	700,500 ..	3,580	Oberlausitz	1,200,000 ..	3,663
Fallersleben..........	870,000 ..	12,790	Obernjesa	750,000 ..	1,880
Gilbach	600,000 ..	7,262†	Oelsburg	270,000 ..	20,100
Görchen	500,000 ..	4,447	Othfresen............	343,200 ..	4,492
Greussen	472,500 ..	19,240	Peine	379,800 ..	2,746
Gross-Düngen........	540,000 ..	630	Rautheim	301,500 ..	5,486
Guhrau	736,000 ..	70,370	Rethen	729,300 ..	30
Güstrow	608,000 ..	137,330	Riesenburg	560,000 ..	36,747
Harsum..............	675,000 ..	767	Salzdahlum	239,400 ..	57,335
Hedwigsburg	465,375 ..	141,927	Schönowitz	814,200 ..	20,450§
Hessen	396,000 ..	22,100	Schortewitz..........	150,000 ..	13,870
Hessen-Oldendorf....	120,000 ..	10,277	Thiede	360,000 ..	3,470
Hohenhameln	300,000 ..	190	Trendelbusch	490,500 ..	4,430
Holland i. Cöthen....	630,000 ..	117,510	Twülpstedt	400,000 ..	26,671
Immendorf	330,000 ..	40,480	Uslar	360,000 ..	190,476
Jerxheim	273,000 ..	63,700‡	Vechelde	300,000 ..	4,420
Klein-Paschleben	403,500 ..	512¶	Weetzen	750,000 ..	5,880
			Wierthe	270,000 ..	21,087
			Zulz	814,200 ..	20,454‖

The following were unable to pay any dividend. The capital is given in brackets:—Bockenem (578,400); Clauen (450,000); Dingelbe (450,000); Fraustadt (1,800,000); Gross-Mahner (443,100); Hornburg (429,000); Lobau (1,200,000); Melno (594,500); Niederndodeleben (350,000); Niederhone (460,000); Oestrum (372,425); Osterwick (417,600); Reinstedt (207,000); Rethen (729,300); Schladen (800,000); Schwetz (790,400); Seesen (371,250); Tiegenhof (660,700); Wismar (1,456,000).

* Reducing the debit balance to M.186,068.
† Reducing the debit balance to M.37,295.
‡ Of which M.44,200 went to cover last year's debit balance.
¶ Reducing the debit balance to M.119,942.
** Loss last year M.93,000.
†† Reducing the debit balance to M.171,900.
‡‡ Reducing the debit balance to M.41,400.
§ Reducing the debit balance to M.32,310.
‖ Reducing the debit balance to M.32,311.

In several of the above cases the small profit was carried to reserve account.

Some new factories are being projected or in course of construction.

LOSSES DECLARED.

Name of Factory.	Capital. Marks.	Net loss. Marks.	Name of Factory.	Capital. Marks.	Net loss. Marks.
Broistedt	412,500 ..	16,290	Holzminden	1,128,900 ..	40,270
Büdingen............	1,000,000 ..	45,485	Neustadt, O.S.	750,000 ..	38,900†
Equord	192,900 ..	23,720	Ottmachau	750,000 ..	7,370‡
Erstein	1,000,000 ..	610	Schottwitz	1,000,000 ..	17,790§
Frankenstein i. Schl..	263,000 ..	64,925	Spora................	556,000 ..	76,470**
Gräben	270,500 ..	2,890	Trachenberg	1,500,000 ..	51,150††
Gross-Ammensleben..	320,000 ..	3,858	Wabern..............	750,000 ..	140,687
Gross-Peterwitz......	699,900 ..	21,008*	Wierzchoslavice	1,002,000 ..	102,804
Goldbeck	720,000 ..	19,175	Wreschen............	675,000 ..	163,620
Hasede-Förste	272,000 ..	3,240			

REFINERIES.

Halle (3,000,000), 8%; Danzig (3,000,000), 7%; Braunschweig, 6½%; Magdeburg (846,000), 5%; Brunonia (600,000), profit, M.21,597.

NOTICES OF BOOKS.

DAS ZUCKERROHR UND SEINE KULTUR. By Dr. W. Krüger. Crown 8vo, pp. 580, with 14 plates and 70 figures in the text. Schallehn & Wollbrück, Magdeburg and Vienna. 1899. 30 marks.

This handsomely bound and well got-up work constitutes, as to the greater part of its contents, an excellent and exhaustive treatise on the sugar cane and its cultivation in Java, other cane sugar producing countries being treated rather summarily, indeed, much too cursorily in comparison with the predominant place assigned to Java, even taking into consideration the fact of the latter being at the present moment the first cane-growing country in the world.

Some idea of the ground covered by the book may be derived from the following summary of its contents: Botanical description of the sugar cane and other species belonging to the genus *Saccharum*.—Morphological and anatomical description of the various parts of the young and mature cane.—Origin and native country of the cultivated cane.—History of cane cultivation in general.—History of cane

* Last year's debit balance M.63,296.
† Last year's debit balance M.86,396.
‡ Last year's debit balance M.23,260.
§ Last year's debit balance M.78,022.
** Last year's debit balance M.51,860.
†† Last year's debit balance M.137,140.

cultivation in Java.—Description of some of the varieties cultivated in Java.—Chemical composition of the cane.—Northern and southern limits of sugar-cane cultivation.—Chemical composition of the soils of canefields.—Tilling and amelioration of the soil.—Manuring.—Rotation of cropping.—Selection and treatment of cuttings and seedlings. —Cultivation of the cane.—Cane pests and diseases.—Harvest operations.—Yield of cane obtained.—Cost of cultivation.—Cost of the sugar extracted.—Statistics of sugar production in all cane growing countries, more particularly Java.

As regards the arrangement of the matter, it seems to us that it would have been better if the historical chapters had been placed towards the end, along with the more statistical portions of the book.

As might well be expected in such a large and comprehensive work as this, the whole of the details are not treated with the same amount of care, and several portions are too long (as, for instance, pp. 287 to 300 on trashing, where, however, no experiments are adduced), but we do not wish to emphasize these few instances in which we do not agree with the author's procedure, as we consider the book as a whole remarkably well written. But there are two objections which we must not omit to mention. The first one (already referred to above), is that if Dr. Krüger meant his book to be a general handbook for the sugar cultivator, he should have dealt more fully and at greater length with cane-growing countries other than Java; moreover, the Javanese words are of no use to anyone but the local planter, and bouws and pikuls should have been given in hectares and kilos. If his book was intended for Java, the author would have done much better to publish it in Dutch. The German colonies referred to in the preface are scarcely likely to be large buyers of the book, as they will not for some time, if ever, produce any notable quantity of cane sugar. The second and more serious objection is that the book is not quite up to date. Dr. Krüger states in the preface that he has taken note of the literature already existing on the subject up to the end of 1897, but it is a great pity that the part treating on cane diseases has not been brought up to our present standard of knowledge, as he could not in that case be acquainted with Wakker and Went's "Diseases of the Sugar Cane," published in the beginning of 1898, or with Raciborski's investigations. It may be that purely technical reasons connected with publishing made it impossible to act otherwise. But even in the treatment of the literature previous to the end of 1897 there are great gaps and omissions. As far as 1891, when Dr. Krüger was still in Java,

everything is fully dealt with, and it would almost seem as if several portions of the book had been written some ten years ago and had received but little revision afterwards. To give a few instances: Dr. Krüger does not mention the two treatises of Wieler in Fünfstück's "Beiträge zur wissenschaftlichen Botanik," both published in 1897.* Then, although he does mention in a few passages Went's investigations on the formation and accumulation of sucrose, he tells us on page 155: "Systematische Untersuchungen über die Zusammensetzung des Zuckerrohrs in seinen einzelnen Vegetationsperioden fehlen selbst noch in Bezug auf seine wichtigsten Bestandtheile." On pp. 166 and 167 he gives certain old and incomplete experiments on the composition of the different parts of the cane stem, without mentioning a word of the later publication on the question, and so in many other passages. On page 147, speaking of the chemical composition of the several varieties (among which he does not name the Manilla cane), the author makes no mention of Moquette or Wakker. The remarks on page 254 on cuttings with one bud are no longer applicable, now that van Musschenbroek has shown that these may very well be used if carefully handled. On page 287 Dr. Krüger tells us that trashing is not in general use in Java; at the present time this statement is certainly not true. On page 184 the author gives, apropos of the leasing of land for cane cultivation to European residents by native proprietors, the Ordinance (not law, as Dr. Krüger calls it, for a law can only be promulgated with the consent of the States General) of the Governor General, dated October 30, 1871; but this was revoked, and replaced by the Ordinance of November 16, 1895.

The same objection of not being up to date may be made regarding the treatment of some of the diseases of the cane. To Dr. Krüger belongs the great merit of having been the first to discriminate between the different diseases of the cane in Java, but it was naturally impossible for him to complete the work during his five years' stay there. Other investigators have continued his work, and have found that he made some mistakes, such as any other naturalist commencing such work would equally have made. And we think that Dr. Krüger, being resident in Germany, and hence not able to control the results arrived at by his successors, would have done well to accept these. Thus, for example, he persists in calling the disease caused by *Cercospora Koepkii* "Rothfleckenkrankheit" though van Breda de Haan

* "Beiträge zur Anatomie des Stockes von Saccharum," and "Die gummösen Verstopfungen des serehkranken Zuckerrohres."

and Wakker have shown that there are in this case two different diseases, the "Gelbfleckenkrankheit" caused by *Cercospora*, and the "Rothfleckenkrankheit," caused by *Coleroa*. In the same category may be cited Krüger's *Uromyces Kuehnii*, of which up to now only uredospores are known (as they do not give rise to basidiospores in germinating), so the name must be *Uredo Kuehnii*. The conidia delineated in fig. 65 (page 449) are Wakker's *Acrothecium lunatum* and do not belong to *Leptosphaeria sacchari*, so that the name "Pilz der Ringfleckenkrankheit der Zuckerrohrblätter" is incorrect. Now that all investigators agree that bacteria are not to be found in the gum of the vascular bundles of canes suffering from *sereh*, Dr. Krüger would have done well to abandon his opinions, or, at any rate, not to have given such strong expression to them as he has on pp. 429 and 430. Java planters will be somewhat astonished on reading, on page 416, in reference to the ananas or pine apple disease: "Obgleich der Schaden bisjetzt noch gering war"—as this, next to *sereh*, is the most serious of the cane pests in Java, though unknown during Dr. Krüger's stay in that country.

We have thought it right to make the above critical remarks, because it is to be regretted that a book in many respects so excellent is not what it ought to be—fully up to date. It is to be hoped that if a second edition should be called for, Dr. Krüger will make good these omissions and inaccuracies in an otherwise valuable and instructive work.

THE AMERICAN SUGAR INDUSTRY. A Practical Manual on the Production of Sugar Beet and Sugar Cane, and the Manufacture of Sugar therefrom. Prefaced by a treatise on the economic aspects of the whole sugar question and its bearings on American agriculture, manufactures, labour and capital. By HERBERT MYRICK. 4to, pp. 220. Many illustrations. 1899. Orange Judd Co., New York, Chicago, and Springfield (Mass.), U.S.A. Sampson, Low, Marston and Co., Fetter Lane, London, E.C., England. Price $1·50, post paid.

This work, which is further entitled, "A Handbook for the Farmer or Manufacturing Capitalist or Labourer, Statesman, or Student," forms, to a large extent, a sequel to that entitled, "Sugar: A new and profitable Industry in the United States," which we noticed in our issue for August, 1897. It brings the history and experiences of the beet sugar industry in the United States up to date, and is very

largely a statement of the results and experiences obtained with beet and cane in that country during the past two years. After the prefatory remarks on the course of legislation in Congress, and the late political occurrences and their effects on the native sugar industry, a chapter, written by Prof. W. C. Stubbs, is devoted to cane sugar, this, however, only extends over ten pages, and the remainder of the book is devoted to the beet industry and its development and future prospects in the United States. The book is fairly what it claims to be, viz., an up-to-date epitome of the "new and promising" beet sugar industry on the North American Continent, forming a reliable guide to the farmer and capitalist, giving the newest scientific, practical, and financial results of the two past seasons, illustrations and descriptions of the newest model sugar mills, the latest experiences in "promoting and operating sugar factories, with instructions how to establish the industry in any given locality." It is certainly the best and most up-to-date publication of the kind which has appeared, and may be recommended to all who wish to form an idea of what is being done and what can be done with beet sugar in the United States.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; 322, High Holborn, London; and 118, New Street, Birmingham.

ENGLISH.—Applications.

3824. W. H. Percy, Bristol. *Improvements in apparatus for dissolving, heating, boiling, concentrating, agitating, scraping, cooling, mixing, and discharging or extruding, and for receiving, cooling, conveying, moulding, and desiccating the discharge or extruded substance, and in the manufacture of farinaceous, gelatinous, glutinous, saccharine, and such like preparations.* 21st February, 1899.

3954. E. I. Dufay, London. *Improvements in the manufacture of sugar.* 22nd February, 1899.

4767. J. Harvey, Glasgow. (A communication by B. Harvey, U.S.) *Improvements in and relating to evaporators.* 4th March, 1899.

5146. C. L. Birmingham and J. R. Chaffer, Highgreen, near Sheffield. *An improved centrifugal machine.* 9th March, 1899.

99234. T. DROST (of F. Drost and Schulz), Berlin. *Improved process of crystallisation applicable for sugar and salts.* 22nd February, 1895. In order to separate evenly concentrated solutions of, for example, sugar or salts into crystallised masses and so to obtain mould sugar in solid even thick pieces, the crystallised masses, formed into the shape of cakes, or at least so welded together that the single crystals cannot change their position in regard to one another, are subjected to a slow rotation so that the liquid by means of its gravity and with the assistance of sugar-shaped boxes which are fixed round the circumference of a slowly rotating drum remains perfectly smooth. Thus the drying of the crystallised masses (for example, mould sugars) can, by the application of heat, be simultaneously effected.

99959. ADOLF KARUTH, Kiew. *Distributing apparatus applicable for vessels for producing crystallisation while in movement.* 30th November, 1897. A cylindrical crystallisation vessel is provided with a perpendicular conveying worm which is surrounded with a casing whose upper end discharges into a distributing sieve. The worm is arranged underneath and above the apparatus, and its movement is such that the crystallised mass is drawn from the lower to the upper part of the apparatus. The apertures of the distributing sieve increase in size the further they are removed from the worm casing, in order that the crystallised mass may be more evenly distributed. Over the vessels, which are provided with a straight instead of a conical floor, a plough-like stirring and conveying arrangement is arranged. The crystallisation vessel is provided at its underneath part with a heating worm, and at its lower part with a cooling worm.

100433. RÖHRIG and KÖNIG, Magdeburg-Sudenburg. *An apparatus applicable for separating liquid from steam.* 25th January, 1898. The steam from which the liquid is to be separated takes an upwardly direction. In the upper part of the receiver, roughened surfaces are provided, and so connected together with connecting pieces that the steam bath above and below the connecting pieces must strike against the roughened surfaces of the sheet metal. The liquid produced in the steam strikes down on these roughened surfaces, is discharged into one of two vessels and is conveyed thence in any suitable manner.

100434. E. BENDEL, Magdeburg-Sudenburg. *An arrestor applicable for the covers of diffusers.* 10th April, 1898. The lower cover of

the diffuser is provided with an eccentric disc upon which a brake block is fixed and is so arranged that the brake action begins with the opening of the cover and attains its highest point only when the latter is completely open. Formerly the cover, during the emptying of the shreddings, was thrown by the pressure of the water with great force against the brickwork of the discharge channel, thus being exposed to the danger of being broken in pieces, which evil is avoided by the present invention.

100787. B. von Sopocko, Warsaw. *Continuous acting centrifugal applicable for casing sugar masses.* 28th March, 1897. The basket of the centrifugal consists of two parts, shaped in the form of a parabola, which can be so arranged as to free one another, the parts being connected by a cylindrical portion. This peculiar shape enables an even and rapid flow of the sugar mass, which is conveyed into the basket through a funnel, to take place in all parts of the same, and consequently a corresponding greater pressure, and thereby a more vigorous action is attained. Circular spaces encircle the centrifugal basket, placed one over another in a step by step manner, provided with separate discharge openings, one or more pipes project from the upper part of the centrifugal into the separate portions of the basket, by means of which cleare is passed in from vessels placed above, so that the sugar mass, before leaving the centrifugal basket is cased with the purest cleare; this cleare, which is now rendered somewhat impure by admixture with molasses, is pumped from a separate discharge opening into the receiver for the second casing pipe for the purpose of accomplishing a continuous white casing of the sugar mass.

101276. W. Baur, New York. *Process applicable for rendering the sludge produced during the process of separation available.* 10th November, 1896. The lime—or strentium—separated sludge, is, in the shape in which it leaves the filter presses, viz., in crumbling pieces, broken up in a disintegrator, and then—during the drying in a rotary drum which is traversed by hot gases—reduced to a pulverulent condition by rotating agitators and finally burned to caustic lime or caustic strentium in a fire-proof rotary drum. The liberated carbonic acid gas, augmented by that produced by the fuel, is continuously made use of for purifying the saccharine juices as well as the burnt powder from the caustic lime or strontium as long as it remains heated, so that a continuous and uninterrupted process of use and re-use of both the converted material and the liberated gases is attained. This process is less costly and much simpler than the

usual process of first pressing the sludge into bricks and then burning them, as this necessitates all the necessary plant for the manufacture of bricks near to the sugar factory.

101194. E. LE BEUF, Paris. *Mash and moulding apparatus, applicable for the continuous refining of raw sugar.* 14th September, 1897. The mash apparatus is provided with a circular hot water casing and a central hot water cylinder, in order to regulate evenly the heat of the sugar mass. Horizontal rakes serving as stirrers are fastened to both parts, shovels are also attached to the floor of the apparatus, which distribute the sugar mass evenly into the moulds placed on a rotary disc passing under the opening in the floor. A pipe with a distributor for moistening the sugar is also provided at the inlet for the same. The above mentioned rotary disc consists of a number of narrow radial chambers which together form a ring, and run upon rollers on a circular line. This disc is connected with a vacuum chamber, in which, during a certain period of the rotation, a vacuum is produced by means of automatic cocks. The sugar moulds are formed of long laths which turn of eccentrically arranged pins, and which are arranged so as to be fixed on the one side and movable on the other, thus permitting the easy emptying of the sugar blocks. A conical roller revolves over the rotary disc for compressing the sugar mass into the moulds. The roller rotates in perpendicular adjustable beds, and corresponds in shape and size with the aforementioned lines of the rotary disc, during the rotation of the rotary cylinder it seizes the moulds, and so presses together the sugar mass. The raw sugar to be refined is pulverised in a mill, moistened on falling into the mash apparatus, and converted into a sugar pulp by means of the treatment by rakes of the mash, heated by the warm water chambers, and thus freed from impure syrup. This is then introduced into the moulds of the rotary disc, pressed by means of the roller into narrow sugar blocks, then rendered perfectly dry by suction by means of the vacuum apparatus, and finally withdrawn from the moulds ready refined.

Patentees of Inventions connected with the production, manufacture, and refining of sugar will find *The International Sugar Journal* the best medium for their advertisements.

The International Sugar Journal has a wide circulation among planters and manufacturers in all sugar-producing countries, as well as among refiners, merchants, commission agents, and brokers, interested in the trade, at home and abroad.

IMPORTS AND EXPORTS OF SUGARS (UNITED KINGDOM).

TO END OF FEBRUARY, 1898 AND 1899.

IMPORTS.

Raw Sugars.	Quantities.		Values.	
	1898.	1899.	1898.	1899.
	Cwts.	Cwts.	£	£
Germany	871,075	618,767	382,775	274,724
Holland	64,465	118,513	25,536	53,300
Belgium	103,235	322,642	44,588	146,250
France	412,590	233,500	199,782	113,770
Java	2,100	37,840	1,092	21,413
Philippine Islands	96,580	62,400	36,950	28,650
Cuba and Porto Rico	....	....	....	....
Peru	302,567	113,140	154,073	59,359
Brazil	104,630	2,685	47,713	1,402
Mauritius	....	870	....	415
British East Indies	19,890	18,120	7,364	8,045
British W. Indies, British Guiana, & Brit. Honduras	223,606	96,602	129,573	71,984
Other Countries	159,833	168,286	77,877	95,046
Total Raw Sugars	2,360,571	1,793,365	1,107,323	874,358
Refined Sugars.				
Germany	1,216,363	1,661,339	791,818	1,019,090
Holland	329,528	377,920	208,209	246,084
Belgium	46,073	34,942	30,661	22,606
France	307,047	393,218	191,632	239,564
United States	2,125	173	2,651	152
Other Countries	21,644	5,910	11,926	3,311
Total Refined Sugars	1,922,780	2,473,502	1,236,897	1,530,807
Molasses	133,988	190,205	33,124	48,071
Total Imports	4,417,339	4,456,892	2,377,344	2,453,236

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden and Norway	13,029	12,529	7,618	7,955
Denmark	23,983	20,092	11,603	10,971
Holland	16,198	16,722	8,846	9,769
Belgium	3,165	2,557	1,684	1,520
Portugal, Azores, &c.	17,196	11,669	9,294	6,514
Italy	7,420	3,693	3,835	2,079
Other Countries	38,135	36,557	21,954	21,029
	119,126	103,819	64,834	59,837
Foreign & Colonial Sugars.				
Refined and Candy	29,434	27,303	17,943	16,670
Unrefined	165,121	67,190	88,096	39,376
Molasses	23,544	21,396	7,030	6,464
Total Exports	337,225	219,708	177,903	122,347

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1899. Tons.		1898. Tons.
Total Receipts, 1st Jan. to 16th March..	335,519	..	237,684
Receipts of Refined ,, ,, ,, ..	1,270	..	6,318
Deliveries ,, ,, ,, ..	336,881	..	256,583
Consumption (4 Ports, Exports deducted) since 1st January	280,438	..	218,083
Importers' Stocks (4 Ports) March 15th..	4,109	..	50,994
Total Stocks, March 22nd..	191,000	..	266,670
Stocks in Cuban Ports, March 22nd ..	67,000	..	113,202
	1898.		1897.
Total Consumption for twelve months ..	2,047,344	..	2,071,413

CUBA.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, 1898 AND 1899.

(Tons of 2,240lbs.)	1898. Tons.		1899. Tons.
Exports	63,845	..	36,177
Stocks	80,019	..	49,958
	143,864		86,135
Local Consumption (two months).. ..	7,800	..	7,650
	151,664		93,785
Stocks on the 1st January (old crop)	1,515	..	4,336
Receipts at Ports up to 28th February..	150,149	..	89,449

JOAQUIN GUMA.

UNITED KINGDOM.

STATEMENT OF TWO MONTHS' IMPORTS, EXPORTS, AND CONSUMPTION FOR THREE YEARS.

	1899. Tons.		1898. Tons.		1897. Tons.
Stock, 1st January	76,930	..	90,030	..	139,623
Imports, Raw Sugar, Jan. 1st to Feb. 28th	89,668	..	118,029	..	71,813
,, Refined, Jan. 1st to Feb. 28th..	123,675	..	96,139	..	91,010
,, Molasses, Jan. 1st to Feb. 28th..	9,501	..	6,699	..	7,856
	299,774		310,897		310,302
Stock, in 4 chief Ports, Feb. 28th	57,000	..	86,000	..	105,000
	242,774		224,897		205,302
Exports (Foreign, and British Refined) ..	10,985	..	16,861	..	11,069
Apparent Consumption for Two months..	231,789		208,036		194,233

Stocks of Sugar in Europe at uneven dates, March 1st to 18th, compared with previous Years.

In thousands of tons, to the nearest thousand.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	Total 1899.
54	799	596	535	170	2154

	1898.	1897.	1896.	1895.
Totals	2310	2514	2206	2078

Twelve Months' Consumption of Sugar in Europe for Three Years, ending 28th February, in thousands of tons.

Great Britain.	Germany	France.	Austria.	Holland, Belgium, &c.	Total 1898-99.	Total 1897-98.	Total 1896-97.
1675	763	580	362	444	3824	3674	3424

Estimated Crop of Beetroot Sugar on the Continent of Europe for the current Campaign, compared with the actual crop of the three previous Campaigns.

(From Licht's Monthly Circular.)

	1898-99. Tons.	1897-98. Tons.	1896-97. Tons.	1895-96. Tons.
Germany	1,725,000	1,852,857	1,836,536	1,615,111
Austria	1,040,000	831,667	934,007	791,405
France	835,000	821,235	752,081	667,853
Russia	745,000	738,715	714,936	712,096
Belgium	220,000	265,397	288,009	235,795
Holland	155,000	125,658	174,206	106,829
Other Countries	160,000	196,245	202,990	156,340
	4,880,000	4,831,774	4,902,765	4,285,429

The official figures of the total amount of beets worked up in Germany during the current campaign of 1898-99 being now available, Mr. Licht has raised his last estimate for that country by 15,000.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

The market during the first few days of March was very firm, and prices of beet advanced about 3d., due partly to some orders from America and partly to some speculative movements. This was succeeded by a quieter tone, but sellers remained exceedingly firm and would accept no reduction. A decline in the amount of visible supplies contributed to this feeling. Since then there has been but little change to report; the statistical position continues to improve, but the American refiners are getting all they want for the time, and can scarcely be expected to re-enter the European market for the present. The figures of probable supplies from Cuba and the Philippines continue to diminish, and with an almost certainty of a considerable reduction having taken place in the invisible supplies, holders are not at all eager to realise. With very small imports and low stocks of cane sugar, transactions are limited, but always at a marked advance on prices of the last week in February, the supplies of low grades being insignificant. Foreign refined sorts are only a shade higher than when we last reported, and the prices current cannot leave much if any profit. There is really, at the moment of writing, no feature of any interest to be mentioned.

The following quotations are in all cases for prompt delivery :—

			Last Month.
Porto Rico, fair to good Refining	11/0 to 12/0	against	10/6 to 11/0
Cuba Centrifugals, 97°/₀ polarization....	11/10½	,,	11/3 to 11/6
Java, No. 14 to 15 D.S.	12/3	,,	11/9 to 12/0
British West India, fair brown	11/0 to 11/3	,,	10/0 to 10/6
Bahia, low to middling brown	9/9 to 10/0	,,	9/0 to 9/6
,, Nos. 8 and 9..	10/3 to 10/6	,,	9/6
Pernams, regular to superior Americanos.	10/6 to 11/0	,,	9/6 to 9/9
Madras Cane Jaggery..	9/6	,,	9/0 to 9/3
Manila Taals	9/0	,,	8/9
French Crystals, No. 3, f.o.b.	11/1½ to 11/3	,,	11/0
Russian Crystals, c.i.f..	?	,,	?
German granulated, f.o.b.	11/3¾	,,	11/0
Tate's Cubes..	15/3	,,	15/3
Beet, German and Austrian, 88%, f.o.b...	9/11½	,,	9/8¼

THE

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☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

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The "Centralblatt für die Zuckerindustrie der Welt," which was first published nearly seven years ago at Magdeburg, has now dropped the last two words of its title, which we consider a distinct advantage, as the name was too long. There is no reason whatever to suppose that any change is intended to be made in the scope of the journal, which will no doubt continue, as hitherto, to publish its very useful, and frequently, specially interesting, articles of information on the sugar industry all over the world.

Messrs. Blyth Bros. & Co., Mauritius, give shipments of sugar from 1st August to 25th March, as 146,891 tons, as against 87,316 tons during the corresponding period of the preceding season. The destinations and quantities of the shipments were :—

	India.	Cape.	Austr.	America.	Europe.	Hong Kong, &c.
1898-99	77,659	18,696	5,677	37,136	5,375	2,348
1897-98	48,148	21,289	10,260	6,108	456	1,055

The colony happily escaped a cyclone which passed very near, and is supposed to have done great damage at Réunion. Prices for white sugars had advanced, consequent on the action of the Indian Government, about one rupee.

Exports from British Guiana from 1st to 10th April:—Sugar, 18,606 tons; rum, 3,984 puns.; molasses, 2,014 casks; cocoa, 18,177 lbs.; against 30,122 tons; 6,366 puns.; 925 casks; and 15,408 lbs. respectively for the like period last year.

The following bounty has been granted by the upper legislative council of Canton Berne to the cultivators of sugar beets during the first five years' working of the Aarberg factory, now in course of erection, viz., 10 cents. per metric quintal (50 kilos.) on all beets grown in the Canton, suitable for and employed in sugar-manufacture. It is stipulated that the factory shall pay these farmers not less than 2 fr. 10 per metric quintal for the beets, and shall return to them in waste products 40 per cent. of the weight of beets delivered, and shall pay railway carriage on their deliveries. The total of such premiums is not to exceed 20 to 25,000 frs.

The German, French, and Austrian sugar journals continue to publish a number of articles respecting the new processes of refining, clarification and manufacture, which are so well known under the name of Say-Gramme, Ranson, &c., and more than one method of using the runnings from the centrifugals for re-introduction into the juice before or during evaporation. The utmost that can be said of these up to now is that they are all more or less on their trial, and that essential details are often suspiciously wanting, so that the greatest caution must be exercised in adopting any of them until more definite results are shown. These remarks are not intended to apply to certain American patents such as the Deming and Lillie systems, the reports respecting which are uniformly favourable, still less to that of Grossé, which certainly seems to offer distinct advantages.

The visit of Sir Cuthbert Quilter and Sir Nevile Lubbock to Barbados does not seem likely to result in anything except to indicate to those most interested that unless they are prepared to be reasonable there is not much prospect of capitalists coming forward in connection with the Central Factory scheme. The Committee appointed to report on the scheme, the outlines of which had been submitted to the Governor, do not appear to have understood the principle which lay at the root of it, and the radical difference between the views of the planters and Sir Cuthbert Quilter is plainly shown in the price of 13s. which the former state that cane now costs, and that of 9s. which is named by the latter as now being paid to small farmers in Trinidad. Sir Cuthbert very well points out "the question is not what the cane is costing the planters to grow, but what it can be grown for." Herein lies the whole question. The methods of cultivation, as well as of manufacture, are indisputably defective and antiquated.

The estimates of the Cuban crop have at length been brought down to a reasonable limit. Messrs. Willett and Gray say (April 13th) :—"We now estimate the total production at 300,000 tons. Mr. Joaquin Gumá (March 31st) "I assume that the amount of the present crop will not exceed 290,000 to 295,000 tons." Will the 1899-1900 crop be much larger? We scarcely think so.

We hear from Java that the prospects of the new crop are far from being so good as was the case last year. The continuous heavy rainfall prevented the growth of the canes, and now they are beginning to "arrow" before they are properly developed. The yield per acre will therefore be inferior to that of last year, and this is only partially compensated by probable greater richness and purity of the juice in the shorter canes.

The countervailing duties on German sugar imported into India will be :—

1. Raw sugar polarising at least 90 per cent. and refined sugar under 98 per cent.—15a. 3p. per cwt.
2. Candy and refined of at least 99½ per cent.—1 rupee 6a. per cwt.
3. All other sugars of at least 98 per cent.—1 rupee 2a. per cwt.

The rupee is worth about 1s. 4d., and there are 16 annas to the rupee, and 6 pice to the anna.

The agreement between the Syndicate of Raw Sugar Manufacturers and that of the Refiners was signed at Berlin on the 7th. The combination, known as the "Kartell," is for the purpose of regulating prices, &c., in the mutual interest of both parties, in a similar way to the action exercised by that which has for some time been in existence in Austria-Hungary, the results of which have been satisfactory to all concerned. The definite conclusion of this agreement has been long delayed because of the reluctance of some manufacturers to have their hands tied in any way. We shall report on this matter more at length next month.

An esteemed correspondent in Hawaii, from whom we have frequently received very interesting information, writes as follows :—"Although we are now part of the great United States of America, the Island laws are still in force, in so far as they do not conflict with those of the United States. The latter are enforcing the Chinese exclusion laws, and I expect almost daily to hear that the U.S. customs and labour laws are to come into force. When or in what

form these islands will be put under regular government is at present conjectural, but we know that we have received the last lot of contract labourers. I do not altogether despair, however, of a sufficient supply of labour, as I think the Japanese will continue to come (as free men) in numbers great enough to meet our needs. And as Japan is about entering into a most favoured nation treaty with America, it is hardly likely that the powerful labour unions will be able to upset that arrangement. Meanwhile, wages have advanced from $1 to $3 per month; the general average paid to Portuguese being $20, to Japanese and Chinamen, $15 per month. I do not believe there is another sugar producing country in the world (not excepting even America) where such high wages are paid to ordinary field hands. In these islands, so long as the price of sugar remains at or near its present level, we can afford to pay such wages. The drought of last season was very hurtful in our district, and few succeeded in getting the balance on the right side. The present year's prospects are much better, but will scarcely reach an average.

"I cannot understand people abroad who are not thoroughly conversant with our climatic conditions on these islands making such bold statements regarding the probable increase of the islands' production. The amount of sugar produced last year by irrigation was 133,006 tons, without irrigation 96,408, a total of 229,414 short tons.* Three new plantations are now under way, all of which will be irrigation producing ones; granting that their output will reach an aggregate of 50,000 tons, which cannot be reached at any rate for four or five years, and with the very best of weather conditions to help the others, it will certainly be three or four years before these islands can produce 300,000 tons, and as to a possible 400,000 tons production, that end is still far distant.

Efforts are being made on this island (Hawaii) to obtain water for irrigation, but I doubt their success, except on a very small scale. The world at large, and the American sugar industry, in particular, need never fear any serious competition from sugar production of the Hawaiian Islands. While the net price to the plantations does not reach lower than 2½c. per lb., we can make a moderate profit, but should the price ever go below that figure, what with high wages and expensive fertilizers a good many of the plantations would be compelled to shut down."

*The report of the Hawaiian Minister of Finance gives a somewhat smaller total figure.—(Ed. *I. S. J.*)

THE STATISTICAL ASPECT OF THE SUGAR QUESTION.

On the 18th April last, a paper by Mr. Martineau on the above subject was read at a meeting of the Royal Statistical Society. The paper is of extraordinary interest and of great value at the present juncture to all who are really concerned to know the "genesis" of this great and growing question, on which so many divergent views are held, and, it must be added, so many erroneous statements are made. The limits of our publication prevent us from—for the moment—doing more than present a brief summary of this valuable compilation, but we shall certainly give next month, if not a much more lengthy abstract, at any rate the numerous tables which form the basis of the paper, and which we are sure will be invaluable for future reference.

Considerable discussion arose on certain special points. Amongst others, Sir R. Giffen expressed the view that through the whole paper there ran the implication that bounties alone had been the cause of the increased production of sugar during the last twenty years. Even if this were a fair assumption we should not dissent from such an implication, because we believe it to be practically correct to assert that the natural growth of consumption would, unless unrestricted by ridiculous and short-sighted taxation, never have raised the production to its present frequently over-inflated position. However, Sir R. Giffen entirely dissented from such a view. He then brought up the question of countervailing duties, and asserted that their institution might possibly not have any of the effects which their advocates expected, alleging that they had a system of countervailing duties in the United States for several years, but no one could say that up to the present the existence of these duties had had any effect whatever in procuring the abolition of these bounties! This is, to say the least of it, a hazardous if not totally incorrect statement, under which no one could expect Sir Nevile Lubbock, who was present, to remain silent, and he very promptly disposed of the fallacy respecting the effect of countervailing duties in the United States.

Sir Henry Norman remarked that nothing he had heard on this occasion had caused him to change the opinions he had expressed in the report of the West India Commission.

We have not been able to gain access to a full report of the discussion, in which, owing to indisposition, Mr. Martineau was unfortunately unable to take part, but it is probable that in some

way or other a further interchange of views may take place, as at least one very extraordinary theory was propounded.

Mr. Martineau's paper commenced by pointing out that though what is known as the sugar question originated some thirty years ago with the bounty on the exportation of refined sugar from France and Holland, it had now extended to the general consideration of the production of beetroot sugar, both raw and refined, on the continent of Europe, stimulated as it is alleged by bounties. How striking had been the progress of the beetroot industry he showed by comparing the sugar production of the world at intervals during the last quarter of a century. In the first decade the cane sugar production was increased by 266,000 tons, and the beetroot production by 640,000 tons. In the second, cane went up 668,000 tons, and beetroot 1,718,000 tons. In the last five years, up to 1897, cane had decreased 474,000 tons, and beet increased 1,415,000 tons. "This decrease in cane production is accidental, being due to the Cuban insurrection. But, apart from this accident, it is clear that the world has now become dependent in the European beet crop for nearly two-thirds of its total visible supply of sugar, and that the supply of sugar and its price are therefore now largely governed by the vicissitudes to which that crop may be subject." Contrasting the yearly production of France and Germany (of which a table is given) for the period 1871-72 to 1884-85, it was pointed out that as regards France, originally at the head of European sugar producing countries, "while in 1871-72 her production was 287,000 tons, 100,000 tons more than the German production, in 1884-85 it was no more than 272,000 tons. It had never risen during that period of fourteen years above 406,000 tons, and the average for the fourteen years was only 325,000 tons in Germany, on the other hand, we find that the production, which in 1871-72 was only 186,000 tons, had risen in the fourteen years to 1,123,000 tons in 1884-85, and that the average production for that period was 497,000 tons."

The fact of France having been so completely distanced by Germany in so short a period is explained by Mr. Martineau as being due to the difference in their legislation. In France the duty up to 1884 was levied on the sugar as it passed into home consumption, there was hence no drawback on exports and no opportunity for a bounty. But in Germany the system was just the reverse. The duty was levied on the weight of roots, according to an estimated yield of sugar, and as this estimated yield was below the actual yield, here was the opportunity for the manufacturer, assisted by the cultivator, to get more

and more sugar free of duty. Careful selection of roots and seed and improved methods of manufacture resulted in the achievement of progress in the cultural as well as technical yield in the factory to such an extent that Germany now stands at the head of all beet growing countries in these respects. In Germany, in 1884-85 the yield of sugar in percentage of weight of roots was 11·02, while that of France was barely 6. Then the French awoke to these facts, and in 1884 the German system was established in France, and still remains in force, though the legal yield has been steadily raised, and two years ago bounties on export were added. In 1884, "the German producer began to feel the inevitable effect of his over-production on the world's price of sugar. In that year the price went down to the lowest point ever known, and then fell to half that price." The result was seen in "a reduction in the German production from 1,123,030 tons in 1884-85 to 838,104 tons in 1885-86, which, it may be incidentally mentioned, sent up prices from 10s. 3d. to 16s. 9d. per cwt." Mr. Martineau next described in detail the changes made in the French and German sugar legislation from 1887 to the present time, including the attempt made in Germany to gradually extinguish the bounties, which attempt eventually ended in doubling the direct bounty by which they had in 1892 superseded the former indirect bounty. The fluctuations in production and yield are well shown in the table for the last 13 campaigns, which we here reproduce :—

Season.	French Production. Tons.	German Production. Tons.	French Yield. Per cent.	German Yield. Per cent.
1885-86	265,071	838,104	7·83	11·43
1886-87	434,043	1,018,281	8·86	11·87
1887-88	347,785	958,863	9·53	13·08
1888-89	414,869	990,891	9·77	11·96
1889-90	700,409	1,261,353	10·47	12·36
1890-91	615,958	1,336,221	9·46	12·09
1891-92	579,420	1,198,025	10·26	12·06
1892-93	523,366	1,230,834	9·56	11·94
1893-94	514,788	1,366,001	9·80	12·34
1894-95	704,454	1,827,973	9·87	12·15
1895-96	593,646	1,637,057	10·97	13·11
1896-97	668,516	1,821,223	9·98	12·66
1897-98	730,067	1,844,399	11·40	12·79

He now proceeded to review in a similar way the varying bounties and production in Austria, Belgium, and Holland, these remarks

being thoroughly illustrated by copious details of figures and tables. The Russian system, and its operation and results in an enormous increase in production and growth in the number of factories, was specially dealt with.

Passing next to the exportation of raw and refined sugar from France, Germany, and Austria, after a brief retrospective glance at the old bounty to the Paris refiners which gave rise to the long series of negotiations of thirty years ago, Mr. Martineau again showed the striking contrast between Germany and Austria on the one hand and France on the other, together with the great increase in the exportation of German and Austrian refined sugar, which now received higher bounties than the raw sugar. The third division of the subject, the cost of production, showed that though Germany was far the cheapest producer among beetroot countries, it was excelled in low cost of production by all cane sugar countries. The concluding division was devoted to the question of price as affected by bounties. In examining in detail the fluctuations during the low priced period of the last fourteen years, he showed, first, that though prices had frequently been forced down below the cost of production, such violent reactions had resulted from these times of artificial and exceptional depression that, on the average, the price of sugar had been above the cost of production during that period; and, secondly, that cane sugar could under natural conditions be supplied at a price substantially lower than the average price of the last fourteen years. Finally, in reference to the frequent assertion that confectioners and other similar industries depended for their success on the maintenance of bounties, Mr. Martineau showed, by analysing the table of the yearly consumption of the United Kingdom since 1872, that the rate of increase of consumption had been less during the low priced years 1886-97 than it had been during the previous period, 1872-85. He did not think from these facts that the abolition of bounties would deprive these people of their plentiful and cheap supply of sugar. He mentioned this fallacy, and used statistics to explode it, because it was now the only delusion left which prevented the people of this country from showing their thorough disapproval of the present protection of foreign producers in British markets.

The conclusions to be drawn from the paper appear to be that production was stimulated by bounties; that cane sugar can be produced cheaper than beetroot; that the frequent unnatural depressions in value caused by artificially stimulated over production,

though disastrous to producers, have, on the average, conferred no exceptional benefit on consumers; that cane sugar can be profitably produced and sold in this country at a price materially lower than the average price of the last fourteen years of alternate depressions and reactions; and that under free and open competition the world would cease to be dependent on the vicissitudes of the European beetroot crop.

With the entire essay before us, we are only too conscious of how far such a summary as the above falls below the merits of this thoroughly exhaustive and remarkable paper, to which we hope to return in our next issue.

CRYSTALLISATION IN MOVEMENT.

In the early part of the present year we received from a gentleman on the American Continent a letter containing some enquiries respecting the results obtained or obtainable by the process of crystallisation in movement, in reply to which we referred him to an article in *The Sugar Cane* for July, 1898, pp. 354–356, but as the figures there given did not seem to altogether meet the case, he drew up a formal statement of the questions on which he desired special enlightenment. This we forwarded to Mr. H. C. Prinsen Geerligs, in Java, and we have now received from that gentleman the following reply, which we publish for the benefit of any other of our subscribers who may wish for information on this important subject. We may add that Mr. Prinsen Geerligs, whose perfect competency in such matters admits of no doubt, is preparing a special paper on the subject, which we hope shortly to present to our readers.

In reply to your questions on crystallisation in movement I beg to hand you some particulars respecting this way of working. It has been observed that on cooling down a sugar solution in movement the crystals grow larger and more regular than when such a solution is cooled down at rest, and that the so-called "false grain" is entirely suppressed. In the case of cane juices containing much glucose the conditions are very favourable for the crystallisation of sugar, permitting the quotient of purity of the molasses occurring among the crystals to be brought down as low as 40°. In this case the molasses are so sticky that a great deal of the crystallised sugar is in the shape of very minute crystals, which interfere with the curing, and require

so much water or steam for "covering" that a portion of the already crystallised sugar is again dissolved, and so the advantage is lost. When such impure masse-cuites (75° to 83° quotient) are cooled down *in movement* the sugar which crystallises out after does not form minute crystals, but adheres to the already existing crystals and is hence recovered along with these on curing. An example of this method will make the point clear.

Three masse-cuites were cooled down at rest and one in motion. Their analyses were fairly the same, viz.:

Cooled.	Masse-cuite.					Molasses.					Grain present.	Grain obtained.	Grain lost per 100 of sugar.
	Sucrose.	Glucose.	Ash.	Water.	Quotient of purity.	Sucrose.	Glucose.	Ash.	Water.	Purity.			
At rest	74·1	11·07	1·54	9·02	81·44	32·9	28·59	3·91	23·37	42·86	61·62	51·51	16·40
,, ,, ...	78·9	8·99	1·16	7·76	85·32	33·7	28·12	3·65	24·50	44·63	68·22	58·81	13·79
,, ,, ...	79·0	8·47	1·15	7·82	85·72	32 2	27·52	3·72	26·12	41·67	69·09	55 28	19·88
,, movement	77·0	9·62	2·51	7·49	83·45	35·3	26·54	6·70	22·94	46·40	64·	64·	..

In this table the figures for the molasses have no reference to the molasses obtained on centrifugalling, but to that which was present between the crystals in the cooled masse-cuite, and hence represented the *mother-liquor* from which the last crystals were crystallised out. From the comparison of the figures of analysis of this molasses with those of the masse-cuite were obtained, in the same manner as was formerly described (*Archief voor de Java-Suikerindustrie*, 1895, p. 53; *Sugar Cane*, 1895, p. 183), the figures representing the quantity of crystallised sugar present. Those for the crystals obtained on centrifugalling are also calculated in like manner,

Masse-cuites having a quotient of 85° and over do not present these difficulties. In their case the mother-liquor is not sticky, and allows the crystallisation to proceed properly even when at rest. In the case of pure masse-cuites, they have to be diluted with hot molasses in order to prevent the stirring apparatus from breaking down. Inasmuch as pure masse-cuites are more the rule than the exception, the success of crystallisation in movement was not great until manufacturers saw their advantage in artificially lowering the quotient of purity of their masse-cuites, by drawing molasses into the vacuum-pan after the masse-cuite had been finished, boiling to

94 Brix and then discharging the mass into the coolers. In this way the quotient of the molasses was brought down as low as 40°, and the grain, being formed in motion, was equally large and easily recoverable. This is the method referred to by Mr. van Hinloopen Labberton in *The Sugar Cane*, 1898, p. 354.

After this introduction I will proceed to answer the questions submitted to me.

1. Yes, the crystalliser will crytallise 1st sugars, but there is no profit in doing this unless the purity of the juice from the mill is usually under 85°. In such case the masse-cuite is boiled to about 93 or 94 Brix at a temperature of 60°, discharged into the crystalliser, where the stirring scoops are already in motion, and kept in movement for about 15 hours, after which it is discharged. If the masse-cuite is too thick, hot (undiluted) molasses are added in the crystallisation, in order to effect dilution of the masse-cuite.

In the case of pure juices, the syrup is boiled into masse-cuite of 96 Brix in the usual way, taking care not to fill the pan more than three-fifths. Then hot undiluted molasses are drawn in, mixed in the pan, and discharged at once. At a temperature of about 70° the Brix of the mixture will be 94. In this way the only advantage is the small amount of extra sugar crystallising out from a masse-cuite of 96 Brix, over and above that crystallising from one of 94, thus saving a little sugar which in the ordinary way would have been carried over in the molasses.

2. If crystallisation takes place under these circumstances the crystals will not be deposited all round the inside of the crystalliser; the masse-cuite mixed with hot molasses forms together a thick broth, resembling the mass coming from a pug-mill.

The third question is already answered. The method of adding molasses to the masse-cuite so as to suppress all after-products is indicated in *The Sugar Cane*, 1898, p. 355. Syrup is boiled into masse-cuite (leaving the vacuum-pan two-fifths empty) of 90 Brix. Next hot molasses are gradually drawn into the pan, calculated in such a way that the quotient is about 70°. Evaporation is carried on until the density reaches 94 Brix. The mixture is then discharged into the crystallisers, with a temperature of 64°C., and cured after a few hours' movement. A portion of the molasses drained off during curing are used for the next filling of the pan, and the rest is either thrown away or sent to the distillery.

THE "LILLIE" SYSTEM OF EVAPORATION.

We are informed that this system, the patents belonging to which are worked by the Sugar Apparatus Manufacturing Company, Philadelphia (see Advertisement on page xii.), and also for this country by McOnie, Harvey & Co., Limited, Glasgow (see Advertisement inside cover), is making good progress, and as regards the sugar industry alone, seventeen refineries in America and England are equipped with the apparatus wholly or in part, the capacity of some extending to the concentration of 300,000 gallons by 75% in twenty-four hours. The proprietors say that it is an apparatus differing radically in its mode of operation and in construction from the old types, and. in consequence, has had to combat conservatism in every industry, so that its now extended use can be accounted for on but one hypothesis—its superiority.

It is claimed by the invention that "in the "Lillie" multiple-effects the density of the concentrated liquor, the liquor levels and the movement of the liquor into the first effect and from effect to effect are all automatically controlled by the discharge valve of the last effect, and further, when it is desired, there is furnished with the multiple-effect an automatic regulator, which operates this discharge valve of the last effect to maintain any density of product for which the regulator may have been set, until the regulator is changed to some other density, which may be done at will. This regulator is very convenient where the density of the thin liquor varies much; for example, in sugar refineries, in which it varies from 1° Beaumé to 15° Beaumé." In the case of one large "Lillie" triple-effect, *each* effect is provided with an independent feed and discharge, and with a density regulator, and frequently different liquors are concentrated simultaneously, one in each effect.

The quantity of liquor in process in the "Lillie" is stated to be small. It is but one-tenth to one-twentieth the quantity in process in the old type evaporators, and it consequently remains in the "Lillie" only one-tenth to one-twentieth as long. This is important where the liquor is liable to discoloration or to injury by heat. In two English sugar refineries "Lillie" single-effects have replaced vacuum pans for boiling down golden syrups to 42° Beaumé, with the result that the product is better in colour. The fact of the small quantity of liquor in process at one and the same time allows the

"Lillie" to be started with a small quantity of liquor, and at the end of the process there is but little material to be worked off.

But perhaps the most remarkable feature connected with this apparatus is its capability of enlargement with the greatest ease by adding a central section, the floor-room required being exactly as before, and the increased height of the double or triple effect being the only change in outward appearance. This transformation, increasing the evaporating power in some cases by as much as 100 per cent., has been effected with complete success in numerous instances. In reference to this special advantage, the manufacturers say:—"The 'Lillie' is the only evaporator in the market whose heating surface can be increased with entirely satisfactory results. The vertical tube or Standard effects cannot be enlarged at all, and of the horizontal tube effects, such as the Wellner Jelinek, it may be said that they cannot be enlarged in a practical and desirable manner, if at all. Had the sugar-house been equipped with either of the old type effects, to have prepared it for the increased grinding capacity of the house would have required the sale of the old effects at a sacrifice, and the purchase of others of greater capacity, with the expenses incidental to tearing out the one and putting in the other, or else an additional multiple-effect would have had to have been added to the plant. It is hardly necessary to dwell upon the advantage which this peculiar feature of the 'Lillie'—capability of enlargement—gives it above all other evaporators for the purchaser of a multiple-effect who may in the future need to add to the capacity of his evaporating plant. It permits him to do this to the extent of 100% or more at a cost far less than that of installing an additional multiple-effect, or of substituting a larger apparatus for the old."

The advantages claimed for the "Lillie" may be summed up as follows:—Mechanical circulation with film evaporation. All functions automatic. Losses from entrainment average less than 1-100 of 1%. Unquestionably the most economical of steam. Capable of forward and reverse working, which tends to keep tubes clean. Far less trouble from incrustations; tubes are never scraped. Capable of future enlargement: One "Lillie" triple-effect was enlarged as much as 100%, and "is doing splendid work," writes the owner. But little juice in process. It is quickly started after juice comes, and quickly shut down after juice stops. Best for quadruple and higher effects, and for plants of great capacities.

SUGAR BOUNTIES.

Possible Re-opening of the Brussels Negotiations.

Mr. George Martineau, who attended last year's Brussels Conference in the capacity of Expert Adviser to the British Delegates, has supplied the West India Committee with the following interesting summary of various articles which have appeared in the Continental Sugar Journals concerning the prospects of negotiations between the Belgian and French Governments being re-opened:—

When the French Government were compelled to reduce their newly created direct bounty, owing to want of funds, there was an opportunity for re-opening negotiations. Again, when the crop of 1897-8 turned out to give a yield of 11.40 per cent. of sugar, which involves an indirect bounty of more than 60 million francs on the beetroot production, and a total bounty, direct and indirect, of at least 100 millions, it was evident that, sooner or later, the French Government would be compelled to repeat the operation of 1887 and 1890, and reduce the bounty by increasing the *prise en charge* or raising the duty on the *excédants*. This is the more imperative because the present crop promises to give a yield of over 12 per cent., while the *prise en charge* is based on a yield of only $7\frac{3}{4}$ per cent. It is impossible that such a state of things can continue, and therefore it is not surprising to hear the report, started by the *Réforme Economique*, that fresh negotiations are impending. We hear from private sources that the French Government have warned the fabricants to be prepared for a change next year, and that the German Government are sounding their manufacturers as to what, in their opinion, would be the effect on the industry if bounties were reduced and consumption stimulated by a reduction of duty. The German industry is taking precautions against a possible loss of bounty by forming a combination of refiners and producers in order to keep up prices in the home market.

The editor of the *Sucrerie Belge* severely criticises the impolitic attitude of France at the Brussels Conference. He says "the French manufacturers must know that the bounties they enjoy are the maximum they can ever attain, and that the reduction of these advantages is only a question of time." France, therefore, made a great mistake in deliberately wrecking the Conference. "Instead of seeking so easy a triumph, France had the greatest interest in taking an active part in the discussions of the Conference. They had given her a favourable position by making special concessions to her, while

all the other countries undertook to completely or almost completely abolish their bounties." "We foresaw already during the Brussels Conference what has now taken place, and we gave a friendly warning to our French colleagues. But they turned a deaf ear. . . . Now they begin to find out the erroneous course in which they have been engaged." A French sugar organ, the *Sucrerie Indigène*, is even more emphatic. It asks what line France is going to take now; will she be as impracticable and obstinate as before? "Since then, and in spite of the obstinacy of the French Delegates, our situation has been modified, and, without having received from others anything in exchange, we have been the first to reduce our export bounties, though nobody asked us to do so. Only recently a demand was made that the *prise en charge* should be increased or the bounty on the excess yield reduced. At this rate we shall be giving more than the Brussels Conference demanded of us. But in return the other countries will maintain their export bounties and other advantages." The *Sucrerie Indigène* thinks, therefore, that the time has come for a change of attitude and a readiness to examine the proposals of the Conference. The Belgian paper, quoting these passages, concludes that "it may not yet be too late to arrive at a rational solution which may satisfy all the producing countries of Europe, but without entirely losing sight of the question of cane sugar as they made the mistake of doing last year at Brussels."

There seems now to be little doubt that the French Minister of Finance seriously contemplated a reduction of bounty. The debate on the Budget of 1899 is, however, now closed, and the French fabricants are safe for another year. They have made a strong protest to the Prime Minister, and demanded a maintenance of the *status quo*. M. Yves Guyot, in the *Siècle*, is very emphatic in his denunciation of the bounty system, which bleeds the French consumer in order to benefit the English, and he predicts that bounties rest on too frail a foundation to last much longer.

M. Dureau, Editor of the *Journal des Fabricants de Sucre*, begins to regard the matter from the same point of view, when he admits that "bounties constitute a deplorable method of competition, and that if production goes on developing in all countries they must evidently end by having no further object." But what will become, he asks, of the beetroot industry when bounties are abolished? The farmers will have to increase their crops and lower their price. "They can do it, but will they?"

The latest news is from Berlin, where it is reported that the Conference will probably reassemble this summer and that its labours may, perhaps, not be without result. Mr. Porter, 'Mr. MacKinley's right-hand man,' is quoted as the authority, and he is reported as saying that France will give up her bounties in return for favourable American duties on her wines, silks, and "confections."

We may add to the above summary an extract from a German paper:—

The views of the Agrarian party in Germany, who are somewhat favourable to the eventual abolition of bounties, are fairly expressed by the the following remarks of Prof. Maercker in the *Deutsche Tages-Zeitung:* "We come now to the question of the bounties. For the present we cannot do without these, so long as other countries do not abolish theirs. The bounties must not be given up until the last remains of the tax on consumption are got rid of. Otherwise our exports of sugar, which just now are of more importance to us than the consumption, would be severely affected. We cannot at present do without the amount received from the bounties without our ability to compete on the world's market being crippled. On the other hand numbers of those interested in the sugar industry are of opinion that in five years from the time Cuba comes to the front, the general conditions will have undergone such a change, that it might appear advisable to commence getting rid of the premiums. And with them would of course have to go the present system of 'Kontingentirung,' and in fact the entire existing sugar legislation. The difficult point of how to find an outlet for our sugar production must, as may easily be foreseen, in future be looked for in our own country; we shall and will continue to export sugar, but it will only be the overplus of our production that we shall send abroad." Professor Maercker sees the only possibility of averting the threatening danger which lies ahead in the certainty of an enormous increase of the Cuban production and the consequent reduction in price, "in the abolition of the tax on consumption and with it of the sugar bounties also."

The sugar manufacturers and refiners are almost unanimously opposed to the abolition of the bounties.

The *Centralblatt für die Zuckerindustrie* announces that a jam factory is to be started at Oldesloe, by a company just formed under the name of "Norddeutsches Jams- Marmeladen- und Honigwerk, C. Timm & Co."

GOLDEN SYRUP.

By Sigmund Stein,

Manager, Crosfield, Barrow & Co., Sugar Refiners, Liverpool.

Second Article.

Since the publication of my first article, numerous further prosecutions, mostly resulting in convictions, have been reported in the public papers.

At Richmond a grocer was summoned for selling golden syrup containing 90 per cent. of glucose syrup, and was fined 40s. At the same court another grocer was summoned for a similar offence, the glucose in this case amounting to 60 per cent. He was fined 40s. At Southwark, another was fined £3 12s. 6d., including costs, the alleged adulteration in this case amounting to 40 per cent. of glucose or starchy matter. At Wimbledon, in another case, a baker was fined 5s. 6d. for selling "fine golden syrup," which proved to be adulterated with 85 per cent. of glucose matter. At Guildford, a grocer was fined 10s. for selling "Clydesdale syrup, made from pure cane sugar," which was not of the nature and quality demanded. Other prosecutions are in progress, and will be reported on later.

In several cases the defendant pleaded that he bought and sold the article in good faith as "golden syrup." In one case it was pointed out by the prosecution that glucose was advertised at 9s. per cwt., while the finest golden syrup cost 24s. 9d., and that people had been convicted for selling "golden syrup" (which properly was refined treacle) containing beet sugar. In one prosecution the label described the article as "pure cane golden syrup," and as being made from pure cane sugar, whereas it proved to be composed of one-third cane sugar and two-thirds glucose syrup. In several cases the excuse brought forward was that the article sold contained nothing unwholesome or injurious to health, and in one case that labels had now been substituted stating that the "golden syrup" was mixed with other substances. In the latter instance the prosecution failed, because the summons had been taken out after the lapse of six months from the commission of the offence, which bars proceedings under the Act.

The following interesting report was made by Mr. C. A. Seyler, Analyst to the Glamorgan County Council:—

"Of the nine samples of golden syrup one was genuine, but thin and of poor quality, four were grossly adulterated with commercial glucose syrup, which practically is made from starch by the action of

acids, and while not harmful, there can be no doubt that its presence is an adulteration, especially in large quantities. These samples I estimated to contain at least 84, 78, 75, and 60 per cent. respectively of this foreign ingredient. Golden syrup should be entirely a product of cane sugar, the starchy glucose being much less sweet and devoid of aroma. All the remaining samples (with the exception of one tin) gave evidence of the addition of smaller amounts of starchy sugar, no doubt added to prevent the syrup from granulating. Whether these samples should be regarded as genuine is open to doubt."

"THE FOOD AND DRUGS ACT, 1875."

The description of offences are stated in this Act as follows :—

"No person shall mix, colour, stain, or powder, or order or permit any other person "to mix, colour, stain, or powder any article of food with any ingredient or material "so as to render such article injurious to health, with intent that the same may be "sold in that state, and no person shall sell any such article so mixed, coloured, stained, "or powdered, under a penalty in each case not exceeding £50 for the first offence. "Offences after conviction for a first offence will be treated as a misdemeanour, for "which the person, on conviction, shall be imprisoned for a period not exceeding six "months with hard labour."

Under Section 5 it is stated:—

"Provided that no person shall be liable to be convicted under either of the two last "foregoing Sections of this Act in respect of the sale of any article or food or of any "drug, if he shows to the satisfaction of the Justices or Court before whom he is "charged that he did not know of the article of food or drug sold by him being so "mixed, coloured, stained, or powdered as in either of these sections mentioned, and "that he could not with reasonable diligence have obtained that knowledge."

Under Section 6 it is stated:—

"No person shall sell, to the prejudice of the purchaser, any article of food or any "drug which is not of the substance and quality of the article demanded by such "purchaser, under a penalty not exceeding £20, provided that the offence shall not be "deemed to be committed under this Section in the following cases, that is to say:— "1st. Where any matter or ingredient not injurious to health has been added to the "food or drug because same is required for the production or preparation thereof as an "article of commerce in the state of food for carriage or consumption, and not "fraudulently to increase the bulk, weight, or measure of the food or drug, or conceal "the inferior quality thereof. * * * * 4th. Where the food or drug is unavoidably "mixed with some extraneous matter in the process of collection or preparation."

Under Section 7 it is stated:—

"No person shall sell any compound article of food or combined drug which is not "composed of ingredients in accordance with the demand of the purchaser under a "penalty not exceeding £20."

SECTION 8.—Provided that no person shall be guilty of any such offences as aforesaid in respect to the sale of an article of food or drug mixed with any matter or ingredient not injurious to health, and not intended fraudulently to increase its bulk, weight, or measure, or conceal its inferior quality, if at the time of delivery of such article or drug he shall supply to the person receiving the same a notice by a label, distinctly or legibly written, to the effect that the same is mixed.

SECTION 9.—No person shall with the intent that same may be sold in its adulterated state without notice, abstract from an article of food any part of it so as to affect injuriously its quality, substance, or nature; and no person shall sell any article so adulterated without making disclosure of the adulteration under a penalty in each case not exceeding £20.

Sale of Food and Drugs Act Amendment Act, 1879.

Section 1 states that in any prosecution under the previous principal Act for selling for the prejudice of the purchaser any article of food or any drug which is not of the nature, substance, and quality of the article demanded by such purchaser, it shall be no defence to such prosecution to allege that the purchaser, having bought only for analysis, was not prejudiced by such sale; neither shall it be a good defence to prove that the article of food or drug in question though defective in nature, substance, or in quality, was not affected in all three respects.

The Merchandise Marks, Law, Consolidation and Amendment Act.

Clause 2 reads as follows :—

Every person who sells, or exposes for, or has in his possession for sale or any purpose of trade, or manufactures any goods or things to which any forged trade mark or false trade description is applied, or to which any trade mark or mark so nearly resembling the trade mark as to be calculated to deceive is falsely applied, as the case may be, shall, unless he proves :—

A.—That having taken all reasonable precaution against committing an offence against this Act, he had at the time of the commission of the alleged offence no reason to suspect the genuineness of the trade mark or trade description, and that

B.—On demand made by or on behalf of the prosecutor, he gave all the information in his power with respect to the persons from whom he obtained such goods or things; or

C.—That otherwise he did act innocently,

be guilty of an offence against this Act.

Penalties Provided.—1. Every person guilty of an offence against this Act shall be liable first, on indictment, to imprisonment with or without hard labour for a term not exceeding two years, or to a fine, or to both imprisonment and fine.

2. On summary conviction, to imprisonment for a term not exceeding four months, or to a fine not exceeding £20 sterling, and in the case of a second or subsequent conviction, to imprisonment with or without hard labour for a term not exceeding six months, or to a fine not exceeding £50.

3. In any case to forfeit to her Majesty every chattel, article, instrument, or thing, by means or in relation to which the offence has been committed.

Clause 3 provides :—(definition)

The expression "trade description" means any description, statement or other indication, direct or indirect :—

A.—As to the number, quantity, measure, gauge, or weight of any goods;

B.—As to the place or country in which any goods were made or produced;

C.—As to the mode of manufacture or producing any goods;

D.—As to the material of which any goods are composed; or

E.—As to any goods being the subject of an existing patent, privilege, or copyright.

The expression "false trade description" means a trade description which is false in a material respect as regards the goods to which it is applied, and includes every alteration of a trade description whether by addition, effacement, or otherwise, where that alteration makes the description false in a material respect.

The provisions under this Act respecting the application of a false trade description to goods shall extend to the application to goods of any such figures, words, or marks, or arrangement or combination thereof, whether including the trade mark or not, as are reasonably calculated to lead persons to believe that the goods are the manufacture or the merchandise of some person other than the person whose manufacture or merchandise they really are, and shall also extend to the application of any false name or initials of a person in a like manner as if such name or initials were a trade description and also to the name or initials of a fictitious person or of some person, not *bona fide* carrying on business in connection with such goods.

The law distinctly says that the purchaser must receive what he asks for. If anyone goes into a shop and asks for "golden syrup," he must receive "golden syrup." There are two quite dissimilar articles, "golden syrup" and "glucose." If golden syrup is demanded, an article which is nothing else than the residue of sugar refining, especially cane sugar refining, must be supplied. In such case an article is required which is nothing else than cane sugar in a form that will not crystallise owing to the organic and inorganic salts and natural glucose it contains. If, however, glucose is supplied instead, it is an entirely different product—an article which is not sweet at all as golden syrup is, has no taste, and is not what is demanded, but is a product derived from corn or starch.

The law expresses itself plainly and distinctly in the words "in accordance with the demand of the purchaser." There can be no argument on this point, and the argument that glucose is quite as nourishing and wholesome as golden syrup is not founded on fact.

The mixing of glucose with golden syrup falls also under section 8 of the Food and Drugs Act, which states: "or conceal its inferior quality," which distinctly means that any mixing of a dark syrup with white glucose to render it a better colour is nothing less than deceiving the public and intended to cover the inferior quality of low syrups. It is simply an attempt to oust the fine refined golden syrup and replace it by a mixture of dark or black syrups with white glucose.

Section 9 states: "No person shall sell any article so altered without making a disclosure of the alteration," which means that if an artificial mixture has been made the public or the purchaser must be informed that such has been done, and that the original article is adulterated with a substance of an inferior quality.

It is of the utmost importance not only that this admixture should be disclosed, but that it should be clearly stated in what percentage the inferior substance is added to the original article, because it would mislead the public or the purchaser to a far greater extent if it was

only stated that such and such a syrup was mixed with glucose, as nobody would know, except after careful analysis, to what extent the inferior glucose was added.

According to the reports of public analysts, and as stated in my analyses given below, the admixture of glucose in syrup varies from 5 to 80 per cent.

This question of stating the percentage of added matter has several times been brought up and debated upon in Parliamentary bills, and it should not only be stated on the label on the article sold, but clearly stated in the invoice.

In all these prosecutions nobody is penalized except the last seller of the article, that is, the man who hands the article over the counter to the consumer.

By this mixing, adulterating and selling, the real character of golden syrup became lost, the syrup market went down to a very low ebb, and the prices once obtained for "golden syrup" have now disappeared through competion with the inferior article.

In former times the public got the genuine refined treacle. Now, owing to the prices being cut down by the mixing system, very little of this genuine article comes on the market.

Another point is the colour. In former times the so called black treacle and dark "golden" syrup was offered to the public, but from year to year experiments have been made, and the public educated to demand a perfectly yellow, straw-coloured syrup.

The colour in the golden syrup has its origin in the caramelization of the sugar during the process of manufacture and refinining, viz., in the heaters, evaporation and vacuum pans, where the syrup becomes gradually darker. Another source is the reduction of the saccharose to natural dextrose, which is accompanied by deterioration and darkening of the colour.

It is very difficult to destroy this caramel colour. Animal charcoal, which is now used as a decolourising agent in sugar refineries, removes this colour only to a certain extent, and is quite powerless to do more, and the remaining syrup is dark even if double or treble the quantity of charcoal is used.

There have been many suggestions made with reference to decolourising dark golden syrups, as, for instance, by hydrogen peroxide, ozone, electricity and different acids. These last agents (acids) are very dangerous on account of their destroying the character

of the syrup, and therefore making it necessary that it should be neutralised by alkalis, (oxide of lime, whiting, marble, etc.). These alkalis, when added to the acid liquor, darken the syrup solution, and make it necessary to use the decolourising agent over and over again.

Another kind of manufacture is the making of syrup from beet sugar.

The processes in manufacturing this "invert syrup" are as follows:—

Beet sugar is dissolved in a vessel and inverted by acid to a certain extent. This means that the saccharose of the beet sugar is partly converted into invert sugar.

The acids generally used are sulphuric and hydrochloric acids. The acid solution is neutralised by soda, if hydrochloric acid is used, and by lime, marble, or whiting, if sulphuric acid is used.

The precipitate formed in the last instancee is filtered in a filter-press, and the clear solution is passed over charcoal, for the purpose of being partly decolourised. Of course a pale syrup can be produced by this process, but it is not the old-fashioned "golden syrup" so much liked by the British public.

I mention this only because it is brought into the market in competition with the pure cane sugar syrup.

It is a pity that the public are guided by the external appearance of the syrup, and take little or no notice of the taste, flavour, or aroma of the real, genuine golden syrup.

It is not the colour that makes the golden syrup, it is the flavour; and if the public would only bring themselves to judge it according to the flavour instead of the colour the syrup trade would develop in a sound direction, and revert to its original position.

The Merchandise Marks Act distinctly states in Clause 2 that "any person who sells any goods or things to which a false trade description is applied, and which is calculated to deceive," is liable to be put in prison.

Clause 3 says (under point 8):—"As to the act of manufacturing or producing any goods."

This plainly means that it must clearly be stated, and the article sold must really correspond with the mode of manufacture that the purchaser demands. If the purchaser demands "golden syrup" he means the residue of cane sugar refining, and does not want to receive a product of starch and glucose.

The term "glucose" comes from the Greek, and means "sweet." Glucose is made from starch by quite a simple process, in which it is converted into sugar.

The formula of starch is $C_6H_{10}O_5$, while that of glucose is $C_6H_{12}O_6$.

The starch is treated with diluted sulphuric acid, which converts it into sugar, and the acid is neutralised by the addition of chalk, which combines with it, and forms an insoluble substance, sulphate of lime or gypsum, which is entirely removed after settling and filtering.

In 1811 Kirchoff, an eminent Russian chemist, discovered that starch could be converted into sugar. The importance of the discovery was universally acknowledged. An industry was started which has grown in America and Europe to a considerable extent. The United States of America produce in their large factories an immense amount of glucose. The export returns for the year 1897 show that about 93,500 tons, of the value of say half a million sterling, were exported, of which the United Kingdom took over 80,000 tons.

The manufacture of glucose has in late years undergone a great change, and is now carried on in the most economical and scientific manner. In spite, however, of this careful manufacture, a large quantity of very inferior stuff is placed on the British market. I have just lately had occasion to make an analysis of some samples of glucose of a very inferior kind. I will not say what causes the inferior quality of glucose to be placed upon the British market, but may remark that the importation of such an article dates from the time that the price of glucose fell so terribly. The margin between raw maize and the finished product, glucose, is so small that the manufacturer can only make both ends meet by selling the by-products, to which great attention has lately been paid. This leads me to think that this may be the reason that more attention is paid to the by-products than to the principal and staple product of the industry, for in spite of all that is said to the contrary, I assert that not only I myself, but many of my colleagues, have of late years met with glucose of inferior quality.

It is quite true that during digestion saccharose is converted into glucose, but it must not be forgotten that it is the dextrose in a chemical sense, and not a mixture of dextrose, maltose, and dextrine.

The organic and inorganic salts in golden syrup, which have quite a different character to the lime salts of commercial or starch glucose,

must not be overlooked. I am not an opponent or an enemy of glucose, but, on the contrary, am favourably disposed towards the industry and wish it every prosperity, but what I do object to is that this industry is pushing aside the old-established industry of the manufacture of "golden syrup," and doing it against the wish of the consumer.

Glucose has found its way into the confectionery, candy, marmalade, and brewing trades. I think that the displacement of cane sugar in these industries is already quite enough, and that glucose should leave her sister competitor, "golden syrup," alone. Of what use is it for the housewife to buy a tin of mixture? If glucose is what the manufacturers pretend—so nourishing, so wholesome—why do they not bring it on the market as such, and sell it as the genuine article, glucose? Why mix this wonderfully good glucose with another substance and call it by the name of the latter?

If the English glucose and syrup mixer and the American and Continental manufacturer wish to acquire or keep the former syrup market, they should come in a straightforward manner and put it on the market under some other name than "golden" syrup, and they will then see whether there is a demand for it, and whether the public think that glucose is an equivalent to syrup.

A great quantity of golden syrup used to be sent from this country to Norway and Sweden, and it was necessary that this syrup should be perfectly pure, without any mixture of glucose whatever, and a high duty was levied on the imported syrup if it contained glucose. This law has been altered, and no such difference is now made in these countries.

I have analysed a great number of samples of golden syrup placed on the English market, and I give the results on the following page, without stating any maker's name, merely putting my laboratory mark and description. From these analyses it is evident that a great difference exists in the quality of these syrups. The admixture that has taken place is shown, and I would draw special attention to the figures relating to salts, which indicate admixture with glucose, because glucose itself contains only 0·6% to 1·2% of salts. I have also fully analysed the salts in the different syrups, and Table II. gives the analyses of such salts.

In my next article I will deal with the question of syrups, which was discussed at the International Congress of Applied Chemistry in Vienna on the 29th July, 1898.

TABLE I.—ANALYSES OF "GOLDEN SYRUP."

Made by SIGMUND STEIN, Liverpool.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	R. L., Liverpool.	K. S., Liverpool.	A. K., Liverpool.	M. S., Liverpool.	L. F., Liverpool.	G. L., Liverpool.	F. S., Liverpool.	R. G., Liverpool.	B. M., London.	W. S., London.	L. M., London.	C. F., London.	L. K., Bristol.	A. F., Bristol.	F. A., Glasgow.	R. C., Glasgow.	A. S., Glasgow.	R. W., Manchester.	F. F., Birmingham.	L. S., Sheffield.	A. T., Greenock.	K. W., Greenock.
Saccharose	38·2	37·2	19·1	31·6	33·3	26·9	12·4	6·9	18·4	33·6	36·4	31·2	32·6	17·9	26·8	31·4	36·9	35·5	28·8	31·7	19·6	36·4
Dextrose	33·4	17·3	28·1	18·5	39·4	18·6	30·6	37·6	42·9	38·6	34·9	19·5	40·6	31·6	42·9	40·6	39·7	19·7	40·30	20·6	36·8	38·6
Levulose		16·8	..	19·6		..	..	..	..	..	..	22·6	..	..	..	..		21·6		19·6	..	
Salts	5·6	6·1	2·9	7·1	5·1	2·4	2·4	2·10	3·1	4·9	5·2	4·1	5·3	3·2	5·6	4·9	5·1	4·1	5·30	4·6	2·4	5·0
Organic Matter ..	10·35	9·3	5·6	6·9	6·4	4·5	4·3	3·80	4·7	9.0	10·80	8·3	7·8	6·20	10·30	7·7	5·5	6·0	11·90	8·9	5·2	7·1
Moisture	12·45	13·30	14·70	16·30	15·80	14·90	17·30	13·40	14·70	13·90	12·70	14·30	13·70	14·20	14·40	15·40	12·80	13·1	13·70	14·60	13·50	12·90
Dextrine	..	..	29·60	..	..	32·70	33·0	36·20	16·2	..	..	..	..	26·90	..	..	..	..	..	..	22·50	..
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

N.B.—Nos. 3, 6, 7, 8, 9, 14, and 21 are evidently mixed with Starch Glucose, while Nos. 1, 5, 10, 11, 13, 15, 16, 17, 19, and 22 are genuine "Golden Syrups."

TABLE II.

ANALYSES OF ASH IN "GOLDEN SYRUP."

By SIGMUND STEIN, Liverpool.

	5	10	11	13	14	15	18	22
	L. F., Liverpool.	W. S., London.	L. M., London.	L. K., Bristol.	A. F., Bristol.	F. A., Glasgow.	R. W., Manchester.	K. W., Greenock.
Total Ash	5·1	4·9	5·2	5·3	3·2	5·6	4·1	5·0
CaO	0·41	0·67	0·51	0·71	0·26	0·91	0·61	0·46
MgO	0·11	0·14	0·17	0·20	0·07	0·04	0·07	0·12
Alkalies	0·31	0·16	0·18	0·19	0·17	0·07	0·18	0·13
Fe_2O_3	0·06	0·04	0·09	0·11	0·04	0·13	0·02	0·14

(To be continued.)

IS THE VISCOSITY A CAUSE OF THE FORMATION OF MOLASSES?

BY DR. H. CLAASSEN.

On perusing what has been written on the causes of the formation of molasses, we find that more or less influence in this direction is constantly attributed to the viscosity. These views were also expressed at the last International Congress for applied chemistry, held in Vienna. By some the viscosity was considered as the only, or at any rate the chief, cause of the formation of molasses; in other quarters a less prominent but still considerable influence was attributed to it, while my opinion is that the viscosity, as such, is never the cause of the formation of molasses. This assertion, which appears to contradict many observations made in practical experience, requires more thorough proof than it was possible to give at the Congress, where the question of the formation of molasses was only barely spoken of. In a practical sense, molasses are the final product of the manufacture of sugar, from which, under the most favourable conditions, no more sugar can be obtained by further concentration and crystallization. Not every final product from the manufacture of

sugar from which no more sugar crystallizes out can be regarded as molasses, but only that from which, even *under the most favourable conditions* for such crystallization, no more sugar crystallizes out.

Among these favourable conditions must be reckoned above all the right adjustment of concentration and temperature, so as to have mother-syrups of the least possible viscosity. In my remarks, "Ueber die Viscosität der Zuckerlösungen und Sirupe" (*Gelbe Hefte*, 1898, page 535), I have pointed out the influence of these two factors upon the viscosity of the syrup, and given the necessary indications for the diminution of the viscosity. It is an undoubted fact that by reducing the viscosity the crystallization of the syrup can be very considerably accelerated, and that, *vice versâ*, a high degree of viscosity, such as is found in a syrup which has been highly concentrated and considerably cooled down, retards the crystallization of the sugar, one may even say will practically put an end to it.

Upon this latter fact is based the opinion that the viscosity is a cause of the formation of molasses. But many of these very viscous syrups, apparently no longer capable of yielding crystals, crystallize very well and abundantly as soon as they are diluted and then properly concentrated and submitted to crystallization in movement at a favourable temperature, with the addition of some crystals for a start.

Hence the viscosity is never the cause of the actual formation of molasses in the same way as the chemico-physical influence of the non-sugar is.

In a true molasses the non-sugar keeps the sugar (and also, *vice versâ*, the sugar the non-sugar) in solution at any degree of concentration on temperature, and therefore it is impossible to nullify this influence of the non-sugar by any change in the conditions of crystallization.

If the viscosity, as such, were the cause of the formation of molasses, then it must, when it reaches a certain degree, render the crystallisation of the sugar impossible; and further, all over-saturated syrups, which at the same time were only slightly viscid, ought to be capable of crystallization, and the more so the lower the degree of their viscosity. The impossibility of drawing such a conclusion, and hence the incorrectness of the proposition, are clearly shown by the following experiments. The determination of the viscosity was effected in a viscometer with an outlet tube of 8mm., in the way described in the work above referred to, with the following results:—

Viscosity of a molasses (or rather of a molasses-like syrup) saturated at 30°, of the following composition: Sugar (Clerget) 47·3 %, water 17·3 %, quotient 57·2 %, at 30° C.; time of running out, expressed in seconds.............. 567

Viscosity of the same syrup, but so far concentrated that it was now saturated at 80°, and possessed the following constitution: Sugar 50·5 %, water 11·7 %, quotient 57·2 %, at 80° 66

If these syrups are evaporated still further, and again cooled down to 30° and 80° respectively—so that at these temperatures they are supersaturated to a degree corresponding with a supersaturation-coefficient of 1·1, and therefore, in case they were still capable of crystallization, sugar could be crystallized from them—the viscosity of the syrup oversaturated at 80° increases to about 90°, while that of the syrup supersaturated at 30° rises to far above 1000. Although, therefore, the syrup in both cases had the same quotient and the same supersaturation, the viscosity of the warmer syrup is extraordinarily less than that of the cold. But it is completely out of the question that more sugar should crystallize out from the former than from the latter, if both are still at all capable of crystallization; it is true that the crystallization of the warmer syrup will take place in about as many days or weeks as that of the cold syrup does perhaps in months, but the final remaining mother-syrups will be molasses of the same purity.

If the viscosity of the warm supersaturated impure syrup of about 90° is compared with the viscosity of a purer syrup supersaturated at an experimental temperature of 38°, the composition of which was as follows: Sugar 52·1%, water 18·6%, quotient 64, its viscosity at 38° is 130. If the viscosity theory is correct, no more sugar can be crystallized from this syrup with a purity of 64 at a temperature of crystallization of 38°, when the molasses-like syrup with a viscosity of 90 will not crystallize any more. But, as a matter of fact, the whole of the sugar which is dissolved over saturation can be crystallized out in a few days from the pure syrup by means of crystallization in movement.

The incorrectness of the viscosity theory is still more clearly demonstrated by comparing the viscosity of a pure supersatured sugar solution with that of a syrup which is likewise supersaturated.

A pure sugar solution, with 77% sugar and 23% water, possessed at 25° a viscosity of 57.

A syrup with 55·6 % sugar, 13·2 % water, and 64·0 purity had at 80°, at which it was highly supersaturated, a viscosity of 36 and at 70°, when it was still more supersaturated, a viscosity of 55.

Now the pure sugar solution will commence to crystallize whenever it is well shaken, in spite of the fact that its viscosity is higher than that of the syrup of 64 purity at 70° to 80°, and not much lower than that of the molasses at 80°, so that it is difficult to make a determination of the viscosity of such a supersaturated sugar solution without the crystals separating out. The crystallization of the less viscous syrup of 64 purity and 70° to 80° temperature requires, however, at the least some hours before it is noticeable, even when some crystals are added to start crystallization.

These experiments show clearly that absolutely no conclusion can be drawn from the viscosity of a syrup as to its capability of crystallization. Only on comparing the viscosities of syrups of exactly similar purity can practically useful conclusions be drawn, as I have shown in my work already mentioned.

The objection which, perhaps, might still be made, that the viscosity caused by the non-sugar acts differently from the viscosity caused by sugar dissolved in excess, is clearly unfounded, as the influence of the viscosity is a purely mechanical one, and therefore all viscosity must constitute in a similar degree the same mechanical obstacle. The non-sugar does not produce molasses by its property of increasing the viscosity, but simply by other physical and above all chemical properties. These latter must be regarded as unalterable, so that it is impossible to produce a lower purity of molasses than that which corresponds with the quantity and quality of the non-sugar. On the other hand, a knowledge of the laws which govern the viscosity of the saturated and supersaturated syrups is of the greatest practical importance, because it is possible on the basis of these to create the most favourable conditions for the crystallization of the sugar and so to approach the ideal of obtaining and centrifugalling out in the shortest time actual molasses as the mother liquor of the last massecuite.—*(Centralblatt f. d. Z. I. der Welt.)*

A company formed at Cadiz in 1897, called the "Sociedad Agricola y Industrial del Guadalete," for starting a beet sugar industry, is proceeding steadily with its work; the irrigation arrangements have been completed, the machinery, which comes from France and Barcelona, is being put into the factory, and it is hoped to start operations next year. An annual output of 4,500 tons of sugar is expected.

Belgium.

Ghent.—Exports of beet sugar for the two last years:—

1897. Tons.		1898. Tons.
45,950	.. ..	40,213

Italy.

Ancona.—Imports of raw sugar for the three past years:—

1896. Tons.		1897. Tons.		1898. Tons.
23,295	....	19,600	....	19,522

Of the quantity for 1898, 13,232 tons came from Austria-Hungary, 4,757 tons from France, and 1,533 tons from Russia. The average price for refined sugar in 1898 was £4 14s. 9d. per 220 lbs.

Spain.

Imports of sugar into the District of Corunna:—

	1897. Tons.		1898. Tons.
Corunna	1,851	....	587
Ferrol	503	....	280
Gijon	189	....	777
Vigo	770	....	417

Egypt.

The values of exported sugar for 1896 and 1897 are given as £784,301 and £650,381. About four-fifths of the total went to the United States in 1897.

Morocco.

In his report for 1897 (issued June, 1898), the British Consul says: "As pointed out in previous reports, loaf sugar is an article which must always be in great demand in this country, even in bad years, when the sale of many other articles is limited. It is a pity, therefore, that English refiners, owing to foreign bounties, cannot have any share in this trade. At present there is great competition here between French and Belgian refiners, the latter having succeeded in gaining a good footing in many districts, though they have not been so successful in Tangier. Belgian sugar is generally packed in bags

of 72 kilos., and used to be sold at about 5fr. per 100 kilos. less than the French sugar; the price, however, has been raised as it has become better established in the market." Imports for 1896 and 1897 are given as follows:—

		1896. Tons.	1897. Tons.
Tangier.	Brown and crushed	93	126
,,	Loaf	549	647
Tetuan.	All sorts	260	241
Laraiche.	,, ,,	3,908	3,488

TURKEY-IN-ASIA.

Jaffa.—Imports of sugar in tons:—1897, 2,273; 1898, 2,600. This sugar comes chiefly from Trieste.

Jeddah.—Imports of sugar in tons:—1896, 460; 1897, 395. This sugar came from Mauritius.

Hodeida.—Imports of sugar in tons:—1897, 2,516. This was chiefly from Egypt and Europe.

Mosul.—Value of sugar imported during 1896 and 1897:—

	1896.	1897.
Raw sugar (Bengal)	£120	£500
Loaf sugar (Europe)	£784	£810

PERSIA.

Imports of sugar into the Persian Gulf ports for 1897 are given as follows:—

	Loaf. Tons.	Soft. Tons.	Candy. Tons.
Bushire	2,819	1,111	..
Lingah	106	225	17
Bandar Abbas	1,125	1,179	22
Bahrain	18½	205	46
Arab Ports	..	525	..

Total value of the above:—Loaf, £78,628; soft, £47,475; candy, £1,986.

The imports are of Mauritius, French, and German origin, but come from London or Bombay. Those coming from France and Germany are reported by the Consul at Bushire "not to have afforded much satisfaction or profit." At Mohammerah the Vice-Consul says that beet sugar (principally French) appears to be entirely replacing cane sugar.

Khorassan.—Russian sugar (loaf and crystallised) is stated to have practically ousted all other sugars. The value of the latter in 1897-98 was only £25, against £58,725 (loaf £39,530 and crystallised £19,195) from Russia.

Siam.

Quantities and values of sugar imported into Bangkok:—

1896. Tons.	£	1897. Tons.	£
4,241	39,707	6,292	62,316

The increase is stated not to correspond with any great difference in consumption.

China.

Exports and imports of sugar from and to the following ports in 1897:—

		Exports. Tons.	Imports. Tons.
Wuchow	brown	42	....
	white	202	....
Kiungchow	brown	7,872	....
	white	1,353	....
Chinkiang	brown	....	15,994
	refined	....	6,032
	sundry	....	1,953
	native	....	14,253
Amoy	brown	5,712	....
	white	580	194
	candy	4,588	....
Chefoo	brown	....	11,516
	white	....	5,092
	native	....	5,922
Canton	white	....	2,788
	brown	....	150
Ningpo	brown	....	430
	candy	....	640
Wuhu	chiefly white	....	5,672
	native	....	282

Remarks.—Sugar-cane is widely cultivated in the province of Kwangsi, three sorts being manufactured—white, brown, and candy. The Consul states it as a remarkable fact that this sugar is *too expensive*

for use in the refineries at Hong-Kong, which draw much of their supplies from Java. The *expense* is largely due to the oppressive local and export duties. The export from Amoy to Japan is burdened in the same way by the *likin* duties. The Kiungchow exports went exclusively to Hong-Kong.

SHANGHAI.

Imports of foreign and native sugar, 1896 and 1897:—

	1896.		1897.	
	Tons.	£	Tons.	£
Foreign white	5,185	....	4,118	49,981
,, brown	21,573	....	44,610	407,474
,, refined	24,863	....	28,267	396,135
Native brown	23,010	....	18,280	171,563
,, white	13,285	....	14,668	178,028
Exports for the same two years:—				
	10,724	....	10,556	117,292

The report says:—"The import of sugar, principally of Javanese origin, but passing through the Hong-Kong refineries, increased (in 1897) by nearly 60 per cent., and is more than double the quantity arriving from the native sugar districts near Swatow. This is a striking example of the shortsightedness of the Chinese Government, which by its duties has killed the very promising refining industry which was started in Swatow, and has thrown it into the hands of a free-trading country."

JAPAN.

The general report on the foreign trade of Japan for 1897 contains the following on sugar:—"The increase in the volume of sugar imports is remarkable, being about 35 per cent. The trade in German beet sugar continues to grow rapidly. During the past season a still larger proportion of the Formosan crop arrived, under the direct orders of Japanese, from British and German firms in that island. Stocks had to be held over for some time, and sold eventually at reduced prices, the loss in weight during the hot weather being also great. Manila sugars are finding more favour in this country than before."

The consul at *Hiogo* says:—"There was in 1897 an increase in value on the sugar imports of 1896 of 40 per cent., and in quantity of

45 per cent. The fall in price was due to the competition of German beet sugar, of which over 12,000 tons were imported, against 6,400 tons in 1896. This increasing success of the German beet in competition with the Hong-Kong refined cane, is no doubt largely due to the bounty on export paid by the German taxpayer, but I think it would be a mistake to attribute it entirely to that cause. Though much inferior in sweetening power, beet sugar has a much nicer appearance than the Hong-Kong cane sugar, and it dries more quickly—a quality which gives it the preference in the manufacture of sweetmeats and candies. A Japanese company has been started for refining in Japan the Formosan yield of sugar, and last year a small refinery was opened in Osaka, the intention being to erect a much larger one at Tokyo as soon as the necessary experience has been acquired."

From *Yokohama* also an increase is noted in the import of brown sugar direct by Japanese (not through the medium of foreign firms) from Formosa, and also in that of European beet, viz.—18,333 tons, against 6,934 tons in 1896; but the greater part of the white sugar still comes from Hong-Kong, and a small portion from Formosa.

As regards *Formosa*, the acting-consul at Tainan gives the following table of quantities of sugar sent to Japan and China in 1897:—

	To Japan. Tons.	To Japan. £	To China and Hong Kong. Tons.	To China and Hong Kong. £	Total. Tons.
Brown	19,444	109,720	14,955	98,226	34,399
White	992	10,795	3,134	35,009	4,126
	20,436	120,515	18,089	133,235	38,525

He remarks:—"The hope expressed in our report for 1893 that the efforts then being made to introduce iron sugar-cane crushing mills into the island might meet with permanent success, has not been fulfilled. The mill which was at that time imported and erected in the neighbourhood of Tainan-fu, although apparently working successfully, found no favour and was discarded. The natives are very conservative, and move slowly in matters which necessitate even a small change, much more a radical one, in their old habits and customs. When the time arrives for the producers to appreciate the value of using the latest machinery, there will be a considerable demand for crushing mills, and a new market should thus open for English-made machinery. Until then, as the production of sugar is

entirely in the hands of native growers, we must perforce wait patiently."

Imports of sugar into Japan for two years:—

	1896. Tons.	1896. £	1897. Tons.	1897. £
Brown sugar	54,648	380,690	73,965	488,462
White sugar	79,809	1,119,032	116,859	1,522,384

Import into Yokohama only:—

	1896. Tons.	1896. £	1897. Tons.	1897. £
Brown	39,785	258,337	54,094	327,994
White	39,882	556,344	57,885	748,222
Molasses and syrup	}	9,985	2,941	6,095
Sundry	}		186	2,943

Export from Tainan (Formosa):—

	1896. Tons.	1896. £	1897. Tons.	1897. £
Brown	31,733	205,659	34,399	207,946
White	3,966	47,106	4,127	45,804

Philippine Islands.

Exports of sugar from Manila, Cebu, and Iloilo, 1896 and 1897 in tons:—

	Manila. Dry.	Manila. Wet.	Cebu. Dry.	Cebu. Wet.	Iloilo. Dry.	Iloilo. Wet.
1896	77,676	20,040	7,485	217	123,720	312
1897	46,345	11,036	15,137	120	129,174	..

Totals:—1896, 229,439 tons; 1897, 201,813 tons. Of this there went in 1897 to—

Great Britain.	United States, &c.	China, &c.	Japan.
49,972	21,409	89,038	39,590

There was in 1897 a considerable increase in the purchases of sugar machinery for Iloilo, planters seemingly being afraid they would not be able to crush the whole of the large crop. Most of this machinery was German.

Ecuador.

The 1897 sugar production amounted to about 6,000 tons, of which some 2,000 tons were exported, chiefly to Chili and Columbia.

Pernambuco.

Production of sugar for ten years (October to September) in bags of about 75 kilos., or very nearly 165 lbs. :—

1887-88	2,490,365	1891-92	1,835,355	1894-95	2,777,415
1888-89	1,726,462	1892-93	1,776,259	1895-96	2,062,568
1889-90	1,489,416	1893-94	2,388,938	1896-97	1,488,206
1890-91	2,089,608				

This gives an average production, for the ten years, of over 150,000 tons.

The exports from the port of Pernambuco for two years were :—

	1896.		1897.		
	Tons.	£	Tons.	£	Destination.
White Sugar	63,645	802,391	58,756	702,655	Native Ports.
,, ,,	300	4,439	62	871	Portugal.
Muscovado	34,157	299,368	25,065	208,335	Native Ports.
,,	46,892	231,446	14,036	66,402	U.S.A.
,,	14,312	66,560	10,257	44,125	U.K.
,,	498	3,708	207	1,532	Portugal.
Yellow Crystals	3,951	38,229	1,621	16,748	U.S.A.
,, ,,	410	3,963	38	1,487	U.K.
Refined	760	12,097	609	9,192	Native Ports.

The British Vice-Consul, writing in March, 1898, remarks respecting the outlook:—

"To newly formed industrial enterprises, and in connection with the attempts to introduce central sugar factories (usines) by the late Governor, the fall in exchange has been disastrous. These factories were to have been built out of the proceeds of loans issued by the State in bonds secured by the mortgage of the estates and machinery. The latter had to be paid for in gold. The bonds issued greatly exceeded the capacity of the money market of absorbing them, consequently their issue price of 1,000 milreis each soon fell to 700 milreis. Hence, with the lack of the necessary working capital and the mismanagement of the *concessionnaires*,, who in many cases proved themselves incompetent for the work demanded of them, but small progress has been made, and great loss has been entailed on both agriculture and trade. Money lenders are getting an exorbitant interest on loans advanced on the bonds, which are guaranteed by the State, and the latter is poorer by several contos of reis, while taxes are increased to pay interest and amortisation. The quantity

of sugar exported is yearly becoming less. In 1897 the United States only took 15,656 tons, and Great Britain only 10,295 tons, out of an export of 110,550 tons.

Rio de Janeiro.

Imports of sugar into Rio during 1896 and 1897 were as follows:—

Origin.	1896. Bags.	1897. Bags.
Pernambuco	1,209,561	389,482
Sergipe		283,811
Campos		177,250
Maceió		69,635
Parahyba		55,183
Bahia		43,855
	1,209,561	1,019,216
Equal to tons	181,000	150.000

Argentine Republic.

Exports of sugar for two years:—

1897. Tons.	1898. Tons.
50,000 (?)	15,834

In 1898, at least seven eighths of the total came to this country. The effect of the large production of 1896—170,000 tons, reduced to 105,000 tons in 1897, and in 1898 not exceeding 80,000 tons—has not yet quite passed away, but as the 1899 crop is not expected to much exceed that of 1898, and prices are much better, it seems likely that things will right themselves. The inland consumption is about 90,000 tons per annum. In 1897 an export bounty of 16 centavos per kilo. was granted, to extend to 25 per cent. of the crop, but as sugar is subject to an inland tax of 6c. per kilo., the bounty is really only 10c. per kilo. net. The consular report for 1898 says:—

"The sugar season just closed has proved more remunerative generally to the manufacturer than that of 1897. The total crop of the whole Republic has only reached 80,000 tons and a smart rise in prices took place, first qualities selling freely, at one time at 4 dol. m/n per 10 kilos. or 31s. per cwt., but the sudden appreciation of the paper currency put a stop to all business for the last two months of the year, and though the sterling value of the production is much the

same, the difference in the paper received represents a large amount to those who were not fortunate enough to sell before the drop in the gold premium commenced.

"The exhibition of national products and manufactures which has lately been held in this city showed that the quality of the sugar (unrefined) produced by many of the factories, has reached a very high standard, and is quite comparable with the bulk of European production."

Paraguay.

The consular report for 1897 says:—

"For the first time, a large sugar factory is about to be established in this country, the situation being on the Tebicuary, close to the railway. It is supplied with the best machinery from England, and is capable of turning out 120,000 arrobas (1,339 tons) of sugar annually, which amount it is thought will render unnecessary the further importation of continental sugar. This importation was from France, Austria, and Germany, and in 1894 reached a value of 102,541 dollars gold, or over £20,000."

Uruguay.

The value of the sugar imported in 1897 was, in round numbers, £278,000, of which £128,000 was refined. Of this Germany sent £50,000; France, £42,000; Great Britain, £32,000. Of the total value of unrefined, £150,000, the Argentine Republic supplied £80,000, and Great Britain £29,300.

Peru.

The total yield of sugar in 1897 was probably over 85,000 tons, of which about 49,000 tons came from the department of La Libertad, on the coast. There are about 25,000 Chinese labourers in the country, and 500 Japanese coolies have been introduced by way of experiment, the contract being for four years. There is a refinery at Santa Rosa, Callao, owned by a British firm, A. Milne & Co.

Chile.

The latest report received comes down only to 1896. The value of the sugar imported during the years 1895 and 1896 is given as

£872,420 and £914,718 respectively. The following table shows the quantities and values of the different classes:—

Year.	Refined Sugar.		White Grainy Sugar.		Muscovados.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Kilos.	£	Kilos.	£	Kilos.	£
1895	7,800,788	280,702	2,784,116	81,472	22,938,589	510,216
1896	7,421,919	270,386	3,191,966	93,390	24,848,451	550,972

The Consul remarks:—"It will be seen that the importation of refined sugar fell in 1896 to 7,421,919 kilos., from 7,800,788 kilos. in 1895. The decline is solely due to the increased business of the native refineries in Viña del Mar and Penco, as is shown by the increase in the imports of raw sugar, which rose from 22,938,589 kilos. in 1895, to 24,848,451 kilos. in 1896. The greater proportion of the raw sugar comes from Peru, but it is very satisfactory to note the increase in the imports of this article from Australia. In 1895 she sent to this port 2,978,931 kilos., valued at £65,906, while the corresponding figures for 1896 are 4,722,497 kilos., with a value of £104,903, representing an increase of 59·17 per cent. Columbia also sent a larger quantity than in the previous year.

"Peru provides nearly the whole of the white grainy sugar, her proportion of the total imports being 98·80 per cent. Germany has the principal trade in the imports of refined sugar, but the figures show a diminution of 19·39 per cent. on the imports from that country in 1895. Great Britain and France both did a larger trade than in the previous year; the former sending 684,545 kilos. in 1896 against 604,954 kilos in 1895; and the latter 869,966 kilos. in 1896 against 205,362 kilos. in 1895."

The total production of sugar in Java for the three last crops is given by the "Archief voor de Java-Suikerindustrie" as follows, *Zaksuiker*, *i.e.*, molasses from which no more sugar can be obtained in the form of crystals, being omitted.

	1896.		1897.		1898.
	Pikols.		Pikols.		Pikols.
	8,255,628	....	9,025,617	....	11,349,523
or, in long tons:—					
	479,121	....	523,808	....	658,677

THE REMOVAL OF FINE GRAIN FORMED DURING EVAPORATION OF SUGAR SYRUPS IN A VACUUM-APPARATUS.

By Dr. Heinrich Winter, of Soerabaia (Java).*

In order to remove the fine grain sugar formed in evaporating sugar syrups, especially after each introduction of fresh syrup, thin syrup or even water has hitherto been drawn at a suitable moment into the vacuum pan to effect the solution of the fine grain. As, however, the quantity of the solvent introduced into the apparatus has for commercial reasons to be kept within certain limits, it may happen that the action of the solvent is insufficient, and accordingly a corresponding quantity of fine grain will remain undissolved.

It also very frequently happens that after a certain time any further introduction of the dissolvent into the evaporating pan becomes impracticable, because by-and-bye the pan becomes so full that there is no longer room for further addition of liquid. In both these cases the endeavour has been made to remove the fine grain by raising the temperature of the contents of the evaporating pan, and this elevation of temperature has been brought about either by partial removal of the cooling water used for the condensation of the vapours or by reducing the action of the air-pump, or by simultaneous application of both means.

Both these methods are, however, quite unsuitable, as the reduction in the formation of steam bubbles on the heating surfaces is accompanied by a reduction of the circulation, and the increase of the temperature is communicated much too slowly to the entire mass, while it is precisely a sudden rise of temperature and an immediate increase in the intermixture that are necessary to gain the end required.

According to the method before us, the desired action is effected—without alteration in the working of the air-pump or in the supply of water for condensation—by introducing air in a finely divided state for a few moments through the bottom of the pan. It rises in the form of fine bubbles uniformly distributed through the boiling syrup, and penetrates the whole mass, and by that means, as well as by the expansion, effects a thorough agitation of the masse-cuite and at the same time passes quickly over the heating surfaces.

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* Patented in Germany, No. 98441.

In this manner a considerable elevation of the temperature may be rapidly produced without—as with the old method—any fear of the formation of products due to over-heating.

The introduction of the air as above described can be effected in different ways, for instance, by a special tube, with numerous perforations, fixed at the bottom of the evaporating pan, or by a double bottom with openings uniformly distributed in the upper one, or a spiral or zig-zag pipe which has a number of tubular outlets passing through the bottom can be fixed below the pan.

The air may be simply drawn in by the operation of the vacuum already existing in the evaporating apparatus, or it can be forced in by pressure if a more rapid agitation and mixing of the masse-cuite with air bubbles is desired.

The technical success depends essentially upon the rapidity with which the fine grain is attacked, and only when the whole mass is at once filled with fine interpenetrating air bubbles can the sudden rise of temperature, essential for dissolving the fine grain, be attained in all parts of the syrup.

This method of passing air quickly and uniformly through the boiling mass can of course, under suitable conditions, replace the introduction of thin syrup or water used for dissolving the fine grain, or it may be combined with it. The air also may be previously heated to the temperature of the mass, and instead of air any other kind of gas may be used.

Reference should here be made to the Patent No. 89784, in which mention is made, although only in a negative sense, of the introduction of air into the vacuum. Even if, in conjunction with the method of treating the mass described in this patent, air were to be used instead of steam, yet the same result could never be attained as by this invention, namely, the removal of fine grain by instantaneously filling the whole masse-cuite with fine air bnbbles.

According to the Patent No. 89784, the steam is introduced in a suitable state of division into the mass only for the purpose of keeping it uniformly agitated, and to maintain a continuous even boiling. If the same effect is attained by air instead of steam, then to keep the whole syrup continually and evenly agitated such a large quantity of air would be required that the absolutely necessary vacuum probably could not be maintained. Above all, if such a large quantity of air were introduced, the technical process above described, on which the success of the present method depends, could never take place.

The well known introduction of air or other gases through capillary tubes, practised in evaporation and distillation in vacuo in chemical laboratories, has in its technical aspect nothing to do with the subject of the invention in question.

CLAIM.

Method for the removal of fine grain sugar formed by the evaporation of sugar syrups in a vacuum apparatus, consisting in introducing spasmodically air in a uniform fine state division into the syrup so as to suddenly interpenetrate the whole masse-cuite with air bubbles, obtaining thereby the solution of the fine grain sugar, and effecting an almost instantaneous increase of temperature throughout all parts of the syrup.

CLERGET'S METHOD OF ESTIMATING SACCHAROSE (CANE SUGAR).

By Arthur R. Ling.

Clerget's method of estimating saccharose, or cane sugar, is widely used for the evaluation of many industrial products. The sugar refiner, the distiller, and perhaps also the brewer, are accustomed to gauge the value of certain saccharine materials which them employ on the basis of the "Clerget Value."

The term "Clerget Value" is, in fact, used as an abstract expression, and the actual information which the method was originally intended to convey—namely, the percentage of saccharose—by the chemist who formulated it, is often lost sight of. Seeing also that numerous modifications of the original plan of carrying out the process have been described, in which the authors omit to mention that the essential object is the estimation of saccharose, there is a danger that Clerget's method may, in the course of time, be degraded to a purely empirical one. I venture to think, therefore, that a brief survey of some of the points in the history of the subject may not be without value, if only for the sake of averting such a catastrophe as that just mentioned.

This paper will accordingly be devoted, in the first place, to reviewing the literature of the subject, and in the second place, to placing on record some values for the rotatory power of invert sugar confirmatory of those obtained by Herzfeld. I wish, however, to disclaim any idea of dealing exhaustively with all that has been written on the subject.

In the early days of quantitative sugar analysis, when the polarimeter was first employed for that purpose, it soon became evident that a single polarimetric observation was inadequate for the deduction of the percentage of saccharose present in many samples of raw sugar. For, neglecting certain optically active non-saccharine substances that occur in raw sugars, many samples, and especially those derived from the sugar cane—are known to contain notable amounts of cupric reducing sugars, consisting in all probability mainly of invert sugar. It is obvious that in any mixture of saccharose and one or more optically active substance, the true percentage of saccharose may be calculated from the values obtained for the optical rotatory power before and after hydrolysis or inversion, provided the agent employed to effect the hydrolysis is without action on the rotatory power of the other constituent or constituents contained in the mixture.

The first to suggest the idea of estimating saccharose in presence of invert sugar from the optical rotatory power before and after hydrolysis with acid, appears to have been Biot (1842). It was, however, Clerget who subsequently (1849) elaborated this process from the results of his exact experiments on the rotatory powers of inverted saccharose solutions at known temperatures.

The polarimeter employed by Clerget was that of Soleil; an aqueous solution of 16·471 grms. of saccharose per 100 c.c. gave a dextro-rotation of 100 scale divisions on this instrument when the solution was observed in a 200-mm. tube. Clerget found that when to a solution of 8·235 grms. (half the normal weight) of saccharose in 50 c.c., 5 c.c. of concentrated fuming hydrochloric acid are added, and the liquid heated on the water-bath in such a manner that its temperature is raised to 68° C. in ten minutes, a constant polarimetric reading is obtained on observing the cooled solution at a definite temperature.

In order to correct for the increased volume due to the addition of acid, the solution was polarised in a 220-mm. tube. The temperature of the solution must be kept constant by providing the tube with a water jacket. The results gave the rotation of a solution of 16·471 grms. (the normal weight) of saccharose after inversion per 100 c.c. in a 200-mm. tube. This, according to Clerget, is – 34 sugar divisions at 20° C. From Clerget's results, which have been confirmed by Casamajor, Ross, Creydt, Bornträger, and others, the following formula is to be deduced:—

$$S = \frac{100\ K}{144 - 0{\cdot}5\ t}$$

in which K=the difference between the polarimetric readings of the solution before and after inversion.

As before stated, Clerget's results have been confirmed by several other observers, and numerous modifications of the method, as originally devised, have been proposed. For a discussion of these I would refer to an excellent paper by A. Bornträger (Zeitschr. Ver. Rübenzuck.-Ind. 1890, 876).

In this country the polarimeter most generally used for saccharimetric purposes is the German instrument, the Soleil-Ventzke-Scheibler, or the improved form of it, the half-shadow polarimeter with quartz compensation, manufactured by Schmidt and Haensch, of Berlin. One of the distinguishing characteristics of these German instruments is that the scale first introduced by Ventzke is adopted, 100 divisions of which correspond to the rotation produced by a solution of 26·048 grms. of saccharose per 100 c.c., observed in a 200-mm. tube. If determinations are carried out according to Clerget's instructions with these instruments, employing, as they do, a higher weight than the French instrument, the inversion constant is somewhat higher.

In the year 1888 a modification of Clerget's method was devised and elaborated under Herzfeld's directions. It is carried out in the following manner:—

The half-normal weight (13·024 grms.) of sugar is dissolved in 75 c.c. of water in a graduated 100-c.c. flask, 38 per cent. hydrochloric acid (5 c.c.) is then added, and the flask, in which a thermometer is inserted, is placed in a water bath at 70° C. The flask is shaken continuously, and in this way the temperature of the solution is raised to 67° to 70° C. in about 2½ minutes, after attaining which it is kept constant for an additional five mintues, when it is rapidly cooled and polarised in a water-jacketed tube, 200 mm. in length at a known temperature. It was found that when the polarimetric observation is made at 20° C., and the reading is multiplied by 2 to raise it to that of a normal solution, the value obtained is —32·66 sugar divisions.

The formula, including the correction for temperature when the observation is made at a temperature other than 20° C., is—

$$S=\frac{100\,K}{142{\cdot}66-0{\cdot}5\,t}.$$

The temperature correction may also be made by Hammerschmidt's formula—

$$I_{20}=I\,t+0{\cdot}0038\,K\,(20-t),$$

in which I_{20} is the reading of the inverted solution in a 200-mm. tube at 20° C., multiplied by 2, $I\,t$ the same at the temperature of observation, and K the difference between the polarisations of the direct and inverted solutions.

If, instead of the half-normal weight in 100 c.c., a solution of a different concentration is employed, the inversion constant varies. The following table gives the inversion constants for solutions containing 1 to 20 grms. of sugar in 100 c.c. The values under I′ are calculated by the formula—

$$I' = -\left(31{\cdot}84 + \frac{i}{20}\right),$$

in which i is the polarimetric reading of the inverted solution in a 200 mm. tube, I being the same multiplied by two.

Sugar, Grms. in 100 c.c.	I.	I′.	Sugar, Grms. in 100 c.c.	I.	I′.
1	31·85	31·90	11	32·52	32·53
2	31·91	31·96	12	32·59	32·60
3	31·98	32·03	13	32·66	32·66
4	32·05	32·09	14	32·73	32·73
5	32·12	32·15	15	32·79	32·79
6	32·18	32·21	16	32·86	32·85
7	32·25	32·28	17	32·93	32·92
8	32·32	32·34	18	33·00	32·98
9	32·39	32·40	19	33·06	33·04
10	32·46	32·46	20	33·13	33·11

The corrections for both temperature and concentration are included in the formula—

$$S = \frac{P - I}{141{\cdot}84 + \frac{i}{20} - \frac{t}{2}}$$

P the direct polarisation.

I = the observed polarisation of the inverted solution corrected proportionately to a normal solution.

P—I K = the observed Clerget constant at $t°$; i = the observed polarisation of the inverted solution in a 200-mm. tube without any correction.

Although the accuracy of Herzfeld's constants has been established by Strohmer, Heyer, and others, it appeared interesting to record the

values obtained by me several years ago ; these are also completely in accord with those of Herzfeld.

The sugar with which these experiments were made was prepared by shaking a concentrated syrup (obtained by dissolving the purest refined sugar in water and concentrating the solution *in vacuo*) with absolute alcohol, collecting the precipitated crystals, washing them with alcohol, again dissolving them in water, and repeating the process. After being well washed with absolute alcohol, the sugar was spread out on a porous tile, and finally dried at a temperature between 60° and 70°C. Normal solutions (26·048 grms. in 100 c.c.) gave a mean reading in the polarimeter of exactly 100 divisions.

Instead of inverting 100 c.c. of a solution, as Herzfeld recommends, it has always been my custom to work with half that volume; and, as I shall show, the results are unaffected by this difference. The sugar (one-fourth the normal weight) is dissolved in 37·5 c.c. of water, and 2·5 c.c. of 38 per cent. hydrochloric acid added. The heating is conducted in the manner prescribed by Herzfeld.

No. of Experiment.	C = Grms. per 100 c.c.	I *t*.	$I_{20°}$ A. R. L.	$I_{20°}$ (from the above table).	Difference between Columns 4 and 5.
1	2	$I_{16} = -33·92$	— 31·92	— 31·91	+ 0·01
2	3	$I_{17} = -33·05$	— 31·55	— 31·98	— 0·43
3	5	$I_{16·5} = -33·92$	— 32·17	— 32·12	+ 0·05
4	7	$I_{17} = -33·90$	— 32·40	— 32·25	+ 0·15
5	10	$I_{17} = -33·90$	— 32·40	— 32·46	— 0·06
6	13·024	$I_{17} = -34·10$	— 32·54	— 32·66	— 0·12
7	13·024	$I_{17·5} = -33·80$	— 32·53	— 32·66	— 0·13
8	13·024	$I_{16·6} = -34·20$	— 32·47	— 32·66	— 0·19
9	13·024	$I_{16·5} = -34·50$	— 32·72	— 32·66	+ 0·06
10	13·024	$I_{16·8} = -34·28$	— 32·65	— 32·66	— 0·01
11	13·024	$I_{19·6} = -32·60$	— 32·40	— 32·66	— 0·26
12	13·024	$I_{19\ 6} = -32·88$	— 32·68	— 32·66	+ 0·02
13	13·024	$I_{20} = -32·44$	— 32·44	— 32·66	— 0·22
14	13·024	$I_{19·4} = -32·92$	— 32·61	— 32·66	— 0·05
15	13·024	$I_{19·8} = -32·72$	— 32·62	— 32·66	— 0·04
16	13·024	$I_{19·6} = -32·92$	— 32·72	— 32·66	+ 0·06

Taking the 11 experiments where the concentrations of the solutions were 13·024 grms. of sugar per 100 c.c., the mean experimental value for I_{20} is —32·61, instead of —32·66, the value obtained by Herzfeld.—(*Journal of the Society of Chemical Industry.*)

POLARISCOPES.

Their use in Tropical Countries.

In our February issue of this year, in an article on "Modern Polariscopes," allusion is made to the lecture delivered by Dr. W. H. Wiley on "The Influence of Temperature on the Rotation of Sugar Solutions, &c.," delivered at the International Congress for Applied Chemistry at Vienna in 1898, the statement being made that Dr. Wiley was the first who pointed out that polariscopes are not correct under all circumstances. At the time we overlooked this statement, or we should certainly have pointed out its inaccuracy, as the fact has been known to users of polariscopes in tropical countries for some seven or eight years, and in our issue for December, 1894, we gave an abstract of a report made by Professor Harrison to the Royal Agricultural and Commercial Society of British Guiana on the desirability of having a standard method fixed for polariscope examinations in that colony, owing to the polariscopes in use being adjusted at a normal temperature of 63·5° F. Of course, Dr. Wiley is in no way responsible for the statement made by the writer of the article in question, but we regret that by an inadvertence we allowed it to pass, overlooking the fact that we had previously published an article which controverts it.

The subject is now exciting some interest in Java, as is shown by the translations given underneath of communications made to the *Archief voor de Java-Suikerindustrie*, Numbers 3 and 4 of this year's issue:—

Influence of the Temperature on the Indication of the Saccharimeter.

The following considerations will show that the high temperature here in India exercises an influence, which cannot be neglected, on the results of the polarisation of sugar solutions:—

To begin with, the specific rotary power of saccharose at various temperatures is not constant, and, according to investigations lately made by Dr. Wiley, with increasing temperature a not inconsiderable diminution is observable.

Thus, for a temperature 4° C. (39·2° F.) the specific rotary power is equivalent to .... 66·653
At 17·5° C. (63·5° F.) the specific rotary power equals........ 66·547
,, 40° C. (104° F.) ,, ,, ,, ... 66·340

The diminution per degree centrigrade averages about 0·0097, though the falling off per degree is not uniform. Let us take as an

example a normal sugar solution (26·048° per 100 cm.) polarised in a 20 cm. tube in a Smith and Haensch polariscope with wedge compensation, such as are very commonly used in sugar laboratories. Let us further assume that the tables used in Europe are graded for a normal temperature of 15° C. (59° F.), while we polarise here at 25° C. (77° F.). The error in this case, due entirely to the specific rotatory power, is, according to Landolt,* not less than 0·21° of the saccharometer scale, and hence the ascertained polarisation must be increased by this amount. Moreover, the specific rotatory power of the wedge compensator is also not uniform. Contrary to what is the case with saccharose, the rotatory power becomes greater as the temperature increases. The error here, with 100° rotation (hence for the normal sugar solution) is equal to 0·15° of the scale. (For the zero point, where the light traverses dextro and lævo rotating quartz-wedges of equal thickness, the error is of course nil). The apparent polarisation of the sugar solution is thus thereby diminished by 0·15°, so that this amount must be correspondingly allowed for.

Finally, the tube, which at 150° C. is exactly 20 cm. long, becomes with increased temperature somewhat longer, and considering that the rotation is correspondent with the length of the tube, the polarisation is thereby made a little too high; the amount of this is however only 0·01° for the normal solution in question, which amount must be deducted from that named above.

Taken together, we find for the case before us:—

	Degrees.
Too little, because of the decrease of the specific rotatory power of the saccharose.	0·21
Too little, because of the increase of the specific rotatory power of the quartz wedge	0·15
Too much, because of the increase in the length of the tube. . . .	0·01
Total minus for 10° increase of temperature	0·35

The practical importance of the foregoing is shown by what follows.

We will assume that the average temperature of the laboratory is 33° C. (which is certainly not far from the truth), and that the saccharimeter is rectified by means of the quartz-plates, as is usually the case. For a quartz-plate of 100° rotation the polarimeter thus shows exactly 100°. For a normal sugar solution of 25° C., it shows, however, according to what is stated above, 0·35° too little, or

*Das optische Drehungsvermoegen organischer Substanzen, 1898.

at 30° C. about 0·525° too little. This gives for a muscovado polarising 96° a minus of about half a degree polarisation or, which amounts to the same thing, one-half per cent. of the weight. Hence there is a loss of ½ katti per picul of sugar, *i.e.*, with a production of 100,000 piculs sold at *f*7 per picul, a sum of *f*3,500, of which the manufacturer makes a present to the purchaser without knowing it.

In view of the new conditions for sale of sugar by the content in pure saccharose, which have lately come into practice in Java, it seemed advisable to call attention to the above-mentioned facts, so that they may eventually be taken into account in concluding such transactions as may be affected by the outcome of the polarisation of the sugar sold.

(Signed) NANNINGA.

FURTHER REMARKS ON THE INFLUENCE OF TEMPERATURE ON THE INDICATION OF THE SACCHARIMETER.

On page 109 of this publication there is a communication from Dr. Nanninga on the above subject, to which I wish to refer, because it is only partially accurate, and so may lead to some confusion. Dr. Nanninga calculates for error in the indication of the polarimeter, due to the temperature prevailing here, and in the case of 96° sugar, the important figure of 0·525 polarimeter degree, and gives three causes contributing to this result. The first of these, that with increased temperature the specific rotatory power of saccharose augments at the rate of 0·21° (Ventzke polarimetric scale) per 10° C., is correct according to the latest investigations of Schoenvock. Further, the error from expansion of the glass tube amounts to about 0·01° V., but, for reasons that do not belong to this matter, brass tubes are to be preferred, and it becomes nearly + 0·02 V. But the third cause, increase of the specific rotating power of the quartz-wedge, is inoperative, inasmuch as it always happens that the instrument is verified here with quartz-plates, the rotation power of which has been ascertained at the European temperature. These quartz-plates can be used at any temperature, because the co-efficient of temperature for positive and negative rotating quartz is the same, and the rotation of the lævo-rotating plate in the half-shadow polariscope makes an equal change in a contrary direction to that exercised by the control-plate.

Recapitulating, we find for 10° C. difference in temperature between here and Europe, and for the 100 point:—

	V.
Too little, because of the decrease of the rotatory power of the saccharose	— 0·21°
Too much, because of the increase in length of the brass tube	+ 0·02°
	— 0·19°

In view of the fact that in Europe generally 17·5° C., and in Java 27·5° C., are accepted as the average temperatures, the actual error is thus much smaller than that stated by Dr. Nanninga.

For 30° C., a temperature which will prevail in most laboratories during the east monsoon, the error becomes about 0·23° V., which, for a sugar polarising 96, equals — 0·22° V.

As regards the practical application of this fact, the following may be noted.

The polarimetric method of examining sugar is a conventional one, and subject to recognised errors. Up to now there has been no regular usage in regard to applying a correction for the influence of temperature. The conditions on which sugar is sold by polarisation are based on the current method of investigation, and hence without correction for temperature. For these reasons the error above discussed, although scientifically recognised, cannot be taken into consideration, and practically it will come to the same thing whether transactions are based on 96·5 pol. uncorrected or 96·7 corrected.

H. Winter.

Soerabaia, February 23rd, 1899.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; 322, High Holborn, London; and 118, New Street, Birmingham.

ENGLISH.—Applications.

5452. S. C. Davidson, London. *Improvements in centrifugal fans or pumps.* 13th March, 1899.

5559. J. J. Hignette, Liverpool. *Improved method of purifying sugar or saccharine juices.* 14th March, 1899.

5684. F. A. Barritt, Maldon, Essex. *Improvements in vacuum pans.* 16th March, 1899.

5801. J. McNeil and C. McNeil, Glasgow. *Improvements in evaporating or concentrating apparatus.* 17th March, 1899.

5802. C. McNeil, Glasgow. *Improvements in evaporating or concentrating apparatus.* 17th March, 1899.

5881. The Honourable C. A. Parsons and A. D. Wass, London. *Improvements in steam turbines.* 17th March, 1899.

5939. A. Kutschbach, London. *Improvements in molasses food compound.* 18th March, 1899.

6093. R. Harvey, Glasgow. (Partly communicated by F. J. Scard, Demerara.) *Improvements in and relating to defecators for sugar juice and like liquors.* 21st March, 1899.

6920. M. J. Davidson, London. *Improvements in mills for pulverizing or pulverizing and mixing.* 30th March, 1899.

7183. W. P. Thompson, Liverpool. (A communication by J. F. Brady, U.S.) *Improvements in elastic fluid turbines.* 5th April, 1899.

7190. P. Porchère, London. *Improvements in the production of sweetening liquids.* 5th April, 1899.

ABRIDGMENT.

8372. J. M. E. Fontenille and H. G. J. R. B. Desormeaux, of Paris. *Process of manufacturing sugar.* 7th April, 1898. This process comprises the following operations:—Adding to the syrup, obtained by melting the raw sugar at a temperature of from 70° to 75° C. and at a density of about 28° Baumé, a quantity of finely powdered animal charcoal (bone black) in the proportion that is sufficient for the evaporation of the raw sugar, and which may vary from 5 to 40 per cent. of the weight of raw sugar, and energetically mixing or stirring up the said charcoal with the syrup at the temperature above stated, until the colour is discharged from the syrup and the charcoal is precipitated when the syrup is at rest. Immediately filtering this syrup either in a press-filter and subsequently washing the charcoal, which is recovered in the form of cakes by the press, which allows the syrup to pass off in a more or less clear state, each of the frames of the press being provided with a double tissue; or, as is more advantageous, in a centrifugal apparatus having a movable basket provided with a filtering tissue, the syrup passing through this tissue and leaving the charcoal in the centrifugal apparatus in the form of a cylindrical cake, which is immediately washed by injecting fine jets of water, which water is returned to the boiler for melting the sugar—the latter mode of working is very rapid. Passing the syrup thus filtered through a re-heating apparatus in such a manner as to restore its temperature, which has become slightly reduced during the preceding filtering operation, to about 75° C. Passing the

syrup, after it leaves the re-heating apparatus, through a "mechanical filter," consisting of pockets which are made of close tissue and are located within a closed vessel in such a manner as to filter the syrup under a pressure of about two metres of water. Boiling the sugar to grain by means of a vacuum and a heating device not appreciably exceeding 100°C. in temperature, such as a water-bath of about 90°C., and kneading the third batch in a vacuum. Washing the fine charcoal that has been employed in the process.

UNITED STATES.—ABRIDGMENTS.

622319. D. AUGSBURGER, Berne, Indiana. *Evaporating apparatus.* April 4th, 1899. This invention relates to a new and useful improvement in evaporating apparatus, and has special relation to such devices for the boiling of molasses, for the purpose of evaporation, in thickening molasses, or in making sugar and the like by steam heat, whereby the temperature may be so regulated as to prevent overheating, yet permit a constant action upon the molasses until the operation is finished; and a further object of this invention is to provide for the transfer of the material being treated from one compartment to another through a series of such compartments, whereby the material may be retained in various degrees and transferred from one to the other until the operation is completed. A further object of the invention is to so construct the steam compartments of the apparatus as to provide for the heating of certain of the reservoir compartments to various degrees to correspond with the various stages through which the material passes.

GERMAN.—ABRIDGMENTS.

100923. J. SCHWAGER, Berlin. *Evaporating apparatus.* 6th March, 1898. The heating portion of the evaporator is composed of cast bodies joined together in such a way that the collective packed joints are accessible from the exterior. The steam enters through suitable inlets placed at even distances the one from the other in the heating chambers, while other openings are arranged for the admittance of the liquid to be evaporated.

Patentees of Inventions connected with the production, manufacture, and refining of sugar will find *The International Sugar Journal* the best medium for their advertisements.

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IMPORTS AND EXPORTS OF SUGAR (UNITED KINGDOM).

To end of March, 1898 and 1899.

IMPORTS.

Raw Sugars.	Quantities.		Values.	
	1898.	1899.	1898.	1899.
	Cwts.	Cwts.	£	£
Germany	1,549,683	993,313	683,730	452,363
Holland	80,758	168,875	31,987	75,089
Belgium	164,755	553,408	70,662	255,883
France	535,623	314,205	257,214	156,641
Java	5,800	49,560	3,127	27,835
Philippine Islands	165,790	62,726	62,298	28,796
Cuba and Porto Rico	3,700	....	2,100	....
Peru	380,898	160,155	192,163	85,142
Brazil	131,953	3,075	60,053	1,602
Mauritius	....	870	....	415
British East Indies	28,400	35,363	10,498	16,098
British W. Indies, British Guiana, & Brit. Honduras	260,506	180,341	150,956	135,535
Other Countries	243,323	258,610	119,334	146,096
Total Raw Sugars	3,551,189	2,780,501	1,644,122	1,381,495
Refined Sugars.				
Germany	2,076,500	2,679,118	1,294,407	1,634,250
Holland	523,358	594,172	331,415	390,003
Belgium	86,252	65,091	56,555	41,655
France	515,414	567,594	318,699	349,125
United States	3,485	752	4,223	1,091
Other Countries	26,230	9,110	14,686	5,221
Total Refined Sugars	3,231,239	3,915,837	2,019,985	2,421,345
Molasses	205,546	298,330	51,511	74,220
Total Imports	6,987,974	6,994,668	3,715,618	3,877,060

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden and Norway	21,942	18,561	12,877	11,622
Denmark	33,417	28,979	16,375	15,604
Holland	27,426	26,617	15,002	15,605
Belgium	4,265	3,067	2,284	1,825
Portugal, Azores, &c.	25,328	23,105	13,639	12,882
Italy	11,690	5,794	6,081	3,285
Other Countries	55,748	56,281	32,030	32,589
	179,816	162,404	98,288	93,312
Foreign & Colonial Sugars.				
Refined and Candy	41,940	42,096	25,495	27,255
Unrefined	188,451	83,451	102,372	48,858
Molasses	56,908	34,959	17,162	10,531
Total Exports	467,115	323,720	243,317	179,956

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1899. Tons.		1898. Tons.
Total Receipts, 1st Jan. to 13th April ..	499,002	..	369,845
Receipts of Refined " " " ..	1,422	..	9,320
Deliveries " " " ..	523,060	..	375,930
Consumption (4 Ports, Exports deducted) since 1st January	418,268	..	299,972
Importers' Stocks (4 Ports) April 12th ..	3,362	..	69,808
Total Stocks, April 26th	202,000	..	345,317
Stocks in Cuban Ports, April 26th ..	86,000	..	81,396
	1898.		1897.
Total Consumption for twelve months ..	2,047,344	..	2,071,413

CUBA.

Statement of Exports and Stocks of Sugar, 1898 and 1899.

(Tons of 2,240lbs.)	1898. Tons.		1899. Tons.
Exports	105,994	..	82,434
Stocks	116,253	..	81,805
	222,247		171,239
Local Consumption (three months) ..	11,300	..	11,000
	233,547		182,239
Stocks on the 1st January (old crop)	1,515	..	4,336
Receipts at Ports up to 31st March ..	232,032	..	177,903

Joaquin Guma.

UNITED KINGDOM.

Statement of Three Months' Imports, Exports, and Consumption for Three Years.

	1899. Tons.		1898. Tons.		1897. Tons.
Stock, 1st January	76,930	..	90,030	..	139,623
Imports, Raw Sugar, Jan. 1st to Mar. 31st	139,025	..	177,559	..	126,883
" Refined, Jan. 1st to Mar. 31st..	195,792	..	161,562	..	151,710
" Molasses, Jan. 1st to Mar. 31st..	14,916	..	10,277	..	14,810
	426,663		439,428		433,026
Stock, in 4 chief Ports, Mar. 31st	52,190	..	77,281	..	87,454
	374,473		362,147		345,572
Exports (Foreign, and British Refined) ..	16,186	..	23,356	..	19,612
Apparent Consumption for Three months .	358,287		338,791		325,960

STOCKS OF SUGAR IN EUROPE AT UNEVEN DATES, APRIL 1ST TO 15TH, COMPARED WITH PREVIOUS YEARS.
IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	TOTAL 1899.
50	668	544	441	142	1845

	1898.	1897.	1896.	1895.
Totals	2071	2200	1980	1950

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 31ST MARCH, IN THOUSANDS OF TONS.

Great Britain.	Germany	France.	Austria.	Holland, Belgium, &c.	Total 1898-99.	Total 1897-98.	Total 1896-97.
1668	771	591	363	442	3835	3690	3380

ESTIMATED CROP OF BEETROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE CURRENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1898-99. Tons.	1897-98. Tons.	1896-97. Tons.	1895-96. Tons.
Germany	1,725,000	1,852,857	1,836,536	1,615,111
Austria	1,040,000	831,667	934,007	791,405
France	835,000	821,235	752,081	667,853
Russia	775,000	738,715	714,936	712,096
Belgium	220,000	265,397	288,009	235,795
Holland	155,000	125,658	174,206	106,829
Other Countries	160,000	196,245	202,990	156,340
	4,910,000	4,831,774	4,902,765	4,285,429

It will be seen that Mr. Licht has raised the estimate for Russia by 30,000 tons.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

Since last writing, the tendency of the market has, on the whole, been upward. To this the growing confidence in the soundness of the statistical position, and the receipt of somewhat larger orders for beet from America have much contributed, and although realisations of May purchases produced a temporary reaction, the tendency is still to advance. The estimates of the Cuban crop, which we have all along considered and declared to be exaggerated, are now perforce being reduced by statisticians, and there is every probability that the figure of 300,000 tons, which we indicated as the maximum to be expected, will not be exceeded. It is difficult to account for the high figures so generally announced and so obstinately adhered to, as the condition of the estates and factories, and the totally inadequate supply of labour and of draught cattle, were facts well known to all interested.

Prices of foreign refined can, with the increased cost of raw material, be leaving no adequate profit to producers, while our home refiners have found themselves seriously hampered by the competition and the advance in raw sorts, especially in beets, which is now 1s. higher than at the end of March.

There are rumours respecting a re-assembling of the Sugar Conference, and the question of abolishing bounties is being considered even in France, but nothing definite has yet come forward. The coming Java and Cuba crops will be small, stocks have again decreased and consumption continues to increase; the outlook is therefore decidedly favourable.

The following quotations are in all cases for prompt delivery :—

			Last Month.
Porto Rico, fair to good Refining	11/6 to 12/6	against	11/0 to 12/0
Cuba Centrifugals, 97°/。 polarization....	12/6	,,	11/10½
Java, No. 14 to 15 D.S.	12/9	,,	12/3
British West India, fair brown	11/9	,,	11/0 to 11/3
Bahia, low to middling brown	10/3 to 10/9	,,	9/9 to 10/0
,, Nos. 8 and 9..	11/0 to 11/3	,,	10/3 to 10/6
Pernams, regular to superior Americanos.	11/3 to 11/9	,,	10/6 to 11/0
Madras Cane Jaggery..	9/9	,,	9/6
Manila Taals	9/6	,,	9/0
French Crystals, No. 3, f.o.b.	12/0	,,	11/1½ to 11/3
Russian Crystals, c.i.f..	?	,,	?
German granulated, f.o.b.	12/3	,,	11/3¾
Tate's Cubes..	16/0	,,	15/3
Beet, German and Austrian, 88%, f.o.b...	11/0	,,	9/11½

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Advertisements from those desiring employment are inserted Free of Charge. All Advertisements to be sent *direct*.

☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

Erratum.—In our May issue, page 227, for "6 pice to the anna" read "12 pies to the anna."

We wish to call attention to a lengthy summary of Mr. Martineau's admirable paper on "The Statistical Aspect of the Sugar Question," of which we gave a short notice last month. This paper, which deserves the careful attention of all interested in the various problems connected with the present position of the sugar industry in general, can be found *in extenso* only in the forthcoming number of the *Journal of the Royal Statistical Society*, published quarterly.

The paragraph in our May issue respecting the *Centralblatt für die Zuckerindustrie* (published at Magdeburg) may be supplemented by the information, not at that time in our possession, that the paper has passed into the hands of a company of sugar manufacturers.

It is not impossible that a swift Nemesis may overtake the hostility manifested by confectioners, jam manufacturers, &c., towards the endeavours of the British refiners to save themselves from apparently impending ruin by means of duties countervailing the unfair bounties granted by foreign nations on exported sugar. The visit of Dr. Degener to this country with the object of enquiring into the manner of conducting the above mentioned trades is already beginning to bear fruit. In our May number we announced the formation in

Germany of a company to start the manufacture of jam and marmalade. and enquiries are now being made for literature on the subject. It is expected that Dr. Degener will shortly publish the results of his investigations, the effect of which will be evident as soon as the preliminary negotiations with the German Government in regard to a special reduction in the consumption tax and other fiscal sugar legislation are completed. It will indeed be "the irony of fate" if German, Belgian, and French preserves, &c., begin to appear in the English and British colonial markets. Shall we then hear a demand for countervailing or protective duties in respect of such imports, or will our jam makers and confectioners be content to submit to quiet extinction, as at present they would have the refiners do?

To the statements combined in our March number respecting the Countervailing Duties in the United States may now be added that the Secretary of the Treasury has decided that the following bounties are given in Belgium on sugars:—

	Per 100 kilos. Frs.
Raw sugar	4·50
Refined sugar..	4·60

The corresponding countervailing duties are consequently to be levied on all sugars imported into the United States from Belgium.

The International Association for Sugar Statistics has received news from Java that the production of the present season amounts to 735,000 tons of raw sugar. The production of next season is estimated at 670,000 tons. This agrees with what we heard from our Java correspondent in April.

The official report of the sugar industry of Queensland for the season just closed, states that 164,000 tons were produced from a total area of 82,000 acres of cane, compared with 98,000 tons from 65,000 acres in the previous season. This shows an average increase in the yield of half a ton per acre.

We have more than once stated that up to now there is nothing definite to go on in regard to the success or otherwise of the Say-Gramme process of clarification by electrolysis. The Deutsche Zucker-industrie of March 30th contains a provisional report from a correspondent (apparently in loco) on the working of the El Hawamdieh (Egypt) factory in which this process is being applied. The writer

seems to intimate that all the difficulties have now been overcome. It cannot, however, be said that there is as yet anything perfectly definite or final in what is communicated by him, and we shall still have to wait for more detailed reports. Dr. Claussen's opinion, given not long ago, was to the effect that the sugar industry has nothing to expect from the application of electricity in the direction indicated.

As regards the treatment of saccharine juices with ozone with a view to effecting a more perfect decolorisation, it is not yet proved that any advantage results from this method, and it appears certain that the expense would stand in the way.

PROVINCIAL EXHIBITION IN GHENT (BELGIUM).—On the occasion of the provincial exhibition, under the patronage of Prince Albert of Belgium and organized under the auspices of the Government, the province of East Flanders and the town of Ghent, a congress on alimentation with an international exhibition of alimentary products will be held in September.

All necessary information will be willingly furnished by all Belgian consuls and consular agents, and by the board of administration of the Provincial Exhibition, Boulevard Leopold, 47, Ghent (Belgium).

To the details given last month respecting the countervailing duties levied on German sugar imported into India may be added the following particulars relating to Austrian sugars :—

	Rs.	a.
1. Sugars polarising at least 88% and under 93%	0	14
2. ,, ,, ,, 93% ,, 99½% ..	0	15
3. ,, ,, ,, 99½%	1	5

As regards sugars from other countries where bounties are granted, the countervailing duties will be practically those levied on the corresponding sugars on their entry into the United States, of which we gave a resumé in our March number, pp. 141-145.

From Barbados we hear that the planters are endeavouring to elaborate a workable scheme for a Central Factory on a smaller scale than those hitherto proposed, by way of trial, and with a view to partially relieve the present unsatisfactory situation. This scheme is to be worked by themselves, as far as possible independent of extraneous capital, and we sincerely hope may come to a successful issue, as it is entirely in a right direction.

GERMANY.

In last month's issue we briefly announced the conclusion of an agreement between the two bodies representing respectively the raw sugar manufacturers and the refiners, and as the matter was tolerably fully discussed at a meeting of the East German Branch of the Sugar Manufacturers' Association held about that time, a translation of a report (slightly abbreviated) of the debate, as given in the *Centralblatt für die Zuckerindustrie*, will enable our readers to form a fair idea of what is intended by this new combination, which is known as "Das Kartell," or, in full, "Das Zuckerkartell."

Dr. Hager (Berlin) made the following remarks:—

Gentlemen,—The negotiations respecting the sugar-combination (Zuckerkartell), are now fully complete, the Zuckerkartell is a *fait accompli.* On the 19th of April a general meeting of the refiners and of the syndicate will take place, but there will be no essential changes made; the matter then comes to the industry. The principles on which the Zuckerkartell will be based are probably approximately known to you. It is not an organisation for sale, like the combination of those interested in alcohol. Each factory retains entire freedom as regards the sale of sugar; the manner of sale continues as formerly, through the medium of agents. What will be effected is simply a fixing of the price. The refiners who supply the home consumption with sugar will have to submit to a certain regulation of their sales. These arrangements do not apply to raw sugar. The obligations which the manufacturers of raw sugar enter into are simply as follows:—They bind themselves during the duration of the Kartell to sell raw sugar and molasses only to those refiners who belong to the Kartell; on the other hand, the latter agree to buy only the production of factories belonging to the Kartell. The price of sugar for home consumption will be somewhat raised, and the raw sugar factories participate in the increase of price which the refiners obtain from the inland consumers. The share of the manufacturers of raw sugar has not been stipulated in such a manner that one could say that the raw sugar factories receive 1 mark per cwt. We start out from a normal price for inland, viz., 12·75 marks for 88 % raw sugar; at this price both the manufacturer and the agriculturist can do very well. When this price has been reached the manufacturers of raw sugar do not participate any further in the profit of the Kartell. On every cwt. of sugar which the refiners produce for home consumption they give a

quota to the raw sugar syndicate, and this quota consists of the difference between the normal inland price and the general price of raw sugar according to a monthly average. If the monthly average has been 10·75 marks, then the difference is 2 marks; consequently the quota which the refiners must contribute to the raw sugar syndicate is 2 marks. It has been said: if the normal price is 12·75 marks, and that price is paid by the refiners, then the raw sugar manufacturers have got a good bargain. That, however, is a mistaken view, because the raw sugar factories do not get all that is necessary to make up 12·75 marks; the raw sugar, of course, anyway costs the refiner 12·75 marks. If, for instance, the average price for raw sugar amounts to 9·50 marks, then the profit of the Kartell amounts to 1·30 marks per cwt.; at 10·50 marks to only 90 pfg.; at 12·50 marks, only 10 pfg.; so that the manufacturer receives 12·60 marks. The higher the universal market price, the better the position of the manufacturer. The profit of the Kartell in itself does not amount to any large gain; the chief thing is that the universal market price shall be high. At 12·75 marks the profit of the Kartell ceases completely. The profit to the refiners must be a stationary one; it is fixed at 50 pfg. per centner for the best loaf sugar; from this are deduced the prices for refined sugar in the future. The price for refined sugar can be made out as follows:—The raw sugar used by the refiner costs 12·75 marks, the margin between raw sugar and refined sugar is taken at 4 marks per cwt. (it has always fluctuated between 3·50 and 3·80 marks). The refined sugar price is, therefore, 12·75 marks *plus* 10·00 marks consumption tax, 4 marks margin, and 50 pfg. profit of the Kartell, together 27·25 marks. This is the minimum price per centner, below which the refiners must not in future deliver any sugar. The maximum price must not be higher than 2 marks above the minimum price, hence at the most 29·25 marks. It may be assumed that prices for home refined sugar will in future move in the lower limit. Austria shows us the example; so long as the Kartell exists, 36 florins are to be paid per double centner.

Now if we compare the price just named with the present price, we find a difference of 2·50 marks, or only 2½ pfg. per lb. In the face of such a fixation of prices, it cannot be contended that we hamper the inland consumption. The refiners are cautious and say—we shall not be able at the commencement of the Kartell to obtain the new price, as there is a large quantity of sugar in the hands of the consumers; consequently for the first two years provisional arrangements have

been made, stipulating that in the first year half of the profit of the Kartell, in the second year three-fourths, and only in the third year the full profit shall be paid. I come now to the conditions on the fulfilment of which the coming into force of the Kartell depends. It has been decided that the Kartell can be formed if 97 per cent. of the contingent have given in their adhesion. If that is attained, it will no longer be necessary for all refineries to be included in the combination. The duration of the Kartell has been fixed for five years.

Next comes the question how the profit of the Kartell is to be divided among the raw sugar factories. The quota of the refiners goes to the refined sugar syndicate, to the raw sugar syndicate, and to those interested. The amount of the profit is to be divided according to the legally fixed "contingent." If we were to take as the basis for division the annually varying contingent, this would give rise to over-production. Therefore a single contingent has been fixed for the five years, viz., that for 1900-1901. This is a perfectly fair basis for the division, with which all factories may be satisfied. In conclusion, I wish to say that it is not possible to bring against this combination the reproach that it will bring about over-production and injure the consumer, for the insignificant difference in price is not sufficient to restrict the consumption.

Director Bierstedt (Neufahrwasser):—

In coming to consider the idea of a sugar combination we must take a far reaching look into the future. You all know that America has been taking large excesses of production from Europe, and you know that America has succeeded in obtaining possession of the "pearl of the Antilles," Cuba. The Americans will not in future be compelled to purchase European sugar, they will have their own sugar. In the interests of our industry this must be laid down in the clearest manner. You know that before the outbreak of hostilities Cuba produced annually from 22,000,000 to 23,000,000 centner of sugar, and you know that during the four years of strife she has only produced annually 2,000,000 to 3,000,000 center. This means a falling off on the part of Cuba of about 80,000,000 centner for the four years, which represents nearly the total annual production of Europe. This "pearl of the Antilles," which, under the defective Spanish administration, and the scarcity of money accompanying it, produced 22,000,000 centner (only a proportionally small area capable of large increase having been cultivated), will, in the hands of the

Americans with their huge capital, be able to produce enormous quantities. I do not wish to paint in too dark colours, but you must know that it is quite within the range of possibility that one day America will be exporting its excess sugar. Now, considering that America threatens to become our competitor, the next question is, where shall we be with our sugar when America is no longer a customer?

If we Germans produce 35,000,000 centners, we have to export 20,000,000. To our export of 20,000,000 we must add that of Austria, Russia, France, and even Sweden, which is thinking of exporting. How shall we stand then? We must come down from our high prices. The English obtain their sugar for 12 to 13 pfg. per lb., while we have to pay 25 pfg.; the result is that England consumes per head of its population per annum some 80 lbs. of sugar, while we, who produce the sugar for England, only consume about 20 lbs. per head. You see what an enormous increase in consumption takes place in consequence of a cheaper price; it would be possible to double or treble the consumption. We shall be compelled to fix cheaper prices. We must endeavour, first of all, to reduce the consumption tax, which increases the cost of sugar by 100 per cent., to 5 marks. Now if we raise the price of sugar 3 pfg. by means of the Kartell, this means 42,000,000 marks for the German consumption. If after this you go to the Chancellor of the Exchequer, the man with the purse, asking him to make a reduction in the tax, then he will say:—You yourselves have artificially raised the price by your Kartell; I am not going to do anything. Three or four years ago the sugar industry here was in a bad way; that is all over now. We have large works, and, therefore, cheap cost of production, the factories are well off, and the price of sugar is now very satisfactory. Besides, the price of land is ten times cheaper here than in central Germany. The price of raw sugar to-day is 10·50 marks; two years ago we only got 8·10 marks, *i.e.*, an advance of 2½ pfg. per lb. We are not at all in a necessitous position, and there is no reason for us to join a Kartell for raising prices. This fact affords grounds for serious consideration.

Dr. Hager: Director Bierstedt first states that the situation of the sugar industry is desperately gloomy, and therefore we need no Kartell. Then he says the position of the sugar industry is a satisfactory one, and therefore we need no Kartell. He has, therefore,

contradicted himself. I fully endorse what Director Bierstedt has said in the first part of his address; a combination has never yet arisen otherwise than in case of need.

Commercial-Councillor Wanfried: Although I have daily opportunities of meeting Director Bierstedt and conversing with him, I have never yet heard anything from him in regard to the Kartell.

I do not share the views of Director Bierstedt. All the factors which he has represented as calamities will, in the first instance, affect our raw sugar factories, and it is urgently necessary for us to take timely measures for their protection. You all know the form of Friedrich Meyer's Sohn, Tangermünde. Mr. Meyer rules the sugar market, or, at least, he supposes that he does. He says that he alone is in a position to be master of the situation. As a matter of fact he has joined the syndicate. I have received a letter from the general secretary, which I will read. I have gone thoroughly into the matter, and must say that I was very reluctant to join any Kartell whatever. In the interest of the raw sugar manufacturer I maintain that it is urgently necessary that we should come to a decision. I am convinced that everything that has been advanced by Director Bierstedt should induce you to join.

Dr. Brukner (Amsee): We have already expressed in the first resolutions our view that we can only take up the idea of forming a Kartell if it pays due regard to the situation of the market. We have succeeded in adapting to the Austrian system the negotiations relating to the Kartell. At the last meeting gentlemen from the East were present, and we have carried through those views which are of vital importance to the East. Our opinions remain unchanged, and we have expressed our sympathetic desires for the Kartell. In the East the cultivation of Beets has attained a high level, beyond which we cannot go. The constant deficiency of labour renders any further extension difficult, or, rather, impossible. When the raw sugar manufacturers have once agreed, then the refiners, who in the meantime still seem to hold aloof, will be compelled to join the Kartell. I hope that the refinery represented by Director Bierstedt will not shut out the thought, but will be compelled to see that the Kartell will bring profit to them.

Dr. Henatsch (Unislaw) was also of the opinion that a cheapening of sugar must be aimed at.

Director Bierstedt: Gentlemen, you are labouring under illusions. You have only the seductive forty-two million marks before your

eyes. It is a pretty sum, but whether it will help the future of our industry is exceedingly doubtful. Time alone will show who is right. A few weeks ago Councillor Wanfried was of my opinion; now he has changed. He has said dozens of times, "Away with the consumption tax." Now he has changed his views, through the influence of Director Blume, of Stettin. I have not said a word to old Mr. Meyer. I have taken my stand on my own personal views, and if, as representative of so large an institution as Neufahrwasser, I express my opinion here, I am not asking for Mr. Meyer, and beg that he may be left out of the discussion. One thing I want to put before you—sugar is an article of food, and not a luxury, and therefore must be cheap.

Councillor Levy (Inowrazlaw): I have no objection to the Kartell as a whole, but I doubt whether what Dr. Hager has said is to the point. Germany exports to the universal market between twenty-one and twenty-two million centner—a large quantity. If another country exports to the universal market, do you think that has no effect upon the general market price? If we raise the price, the price abroad will fall. It might be said that that does not concern us; we have our 12.75 marks; but if the universal market price, which at present stands at 9 marks, goes down to 8·50 or 8·70 marks, then the contribution which the refiners will have to pay us will enormously increase the inland price for white sugars, and we shall, as Director Bierstedt says, hamper the consumption. I have no objection to the principle of the Kartell, but I do beg that the matter may be maturely considered.

Wanfried (Danzig): I still adhere to the view that it is right that the consumption tax should be reduced. With regard to the question of the increase of price I may remark that we have a clear example in America. Combinations have been in existence there for a long time. The consumption increases from year to year, but no considerable increase of price can take place. It was very difficult for me to associate myself with the movement to establish a Kartell, but I am convinced that it is a necessity, even in your interests, the interests of the raw sugar manufacturers.

Director Rabe (Dirschau): I am opposed to the formation of a Kartell. The universal market price is not favourably influenced by it, and the benefit to be derived from it cannot be great. What position my factory will take I do not know, I am only expressing my personal views.

König (Berlin): I only intend to lay my own view on this matter before you. I am very much in favour of it. From all sides it has been emphasized that the German sugar industry has to reckon with the competition of other countries, and therefore the industry must prepare for the struggle by means of the Kartell. The industry and the manufacturers should regard it with satisfaction. It has been said the Kartell will interfere with the inland price and will not increase the consumption, and that to increase the consumption it is essential to lower the price. I will not deny the fact that the price has a certain influence on the consumption of sugar. But if we keep in view as our object a preparation for the struggle, we must proceed systematically. How must we prepare for the fight? First of all, the Kartell. The industry will thereby be made strong, and, thus strengthened, can enter upon the struggle with greater prospects of success. When we have combined, then the industry will be strong enough to approach the question of the reduction of the consumption tax now advocated, then we shall be able to prevent the State from putting so much money into its coffers.

As a sequel to the above report, it will be useful to give the following translation of part of a leading article which lately appeared in the *Journal des Fabricants de Sucre*, from the pen of its very able and competent editor:—"For the last fifteen years a most interesting phenomenon to large sugar producing and consuming countries has presented itself in Germany and Austria-Hungary; we refer to the continuous development of the export of refined sugars, or raw sugar fit for direct consumption, and the corresponding diminution of the export of raw sugars for refining. In Germany, the exports of refined sugar, which during the period 1873 to 1883, had only formed 22 % of the total export, increased to 30 % during the succeeding decennial period, and to 45 % during the five years following. In 1898-1899, Germany even exported more refined than raw sugar, viz., 503,928, against 478,941 tons. In the case of Austria this phase of evolution is even more remarkable. The proportion between refined sugar and the total export went from 42 % to 60 % and 80 % during the three periods under consideration, and in 1897 only 31,449 tons of raw sugar left the monarchy, against 460,154 tons of refined. So that, if this movement should continue, in a few years Austria-Hungary will have ceased to export raw sugar."

"Now, what are the causes of this remarkable evolution? As far

as we know, there are at least three such causes. The first, of a fiscal nature, is the faculty of exporting, with the benefit of the refined bounty, white sugars which have not undergone the process of refining properly so-called; the second results from the progress achieved in a technical direction, and from the simplification of refining operations and of the direct manufacture of sugars fit for consumption, which has brought these processes within the reach of a large number of manufacturers; the third is a consequence of the specially advantageous position in which the refiners are placed by the "Kartell" or general syndicate of the manufacturers and refiners.

Since this "Kartell" has been in existence—that is, since the 31st October, 1897—the price of refined, as compared with that of raw sugar, has, as is well known, been materially raised; the refiners, favoured by prohibitive customs duties, and in concert with the producers of raw sugar, have established an artificial margin in price, from which they have derived an unusually large profit on their sales for internal consumption, and which, by improving their position in the home market, facilitates their export of refined sugars for the universal market. The manufacturers of raw sugar, on their side, profiting by a portion of the artificial margin on the quantity delivered to the refiners, find it more advantageous to sell their production to the latter than to send it abroad. In this connection the following table, showing the margin per kilo. between raw sugar and duty-paid refined will not be without interest:—

Year.	88% Raw sugar at Aussig. Florins.	Refined sugar duty-paid at Prague. Florins.	Margin between raw and refined. Florins.
1895	12·78	28·71	15·93
1896	13·73	35·27	21·54
1897	11·84	33·90	22·06
1898	12·67	36·00	23·33

"According to this, the margin in price between raw sugar 88% delivered at Aussig and refined sugar (duty included) has been raised successively from fl. 15·93 in 1895 to fl. 22·06 in 1897 and 23·33 in 1898. It should be mentioned here that the tax on consumption was raised from fl. 11 to fl. 13, commencing with 7th July, 1896. The influence of the 'Kartell' made itself felt from the year 1896, even before it had officially come into operation, and since 1898 this influence has manifested itself in a perfectly regular way. Let us take, for example, the quotations on the 22nd March of the two years, 1898 and 1899, and compare them with those of 1895:—

	1895. Florins.		March 22, 1898. Florins.		March 22, 1899. Florins.
Pilé, carriage paid to Trieste.	14·24	..	13·50	..	13·50
Export premium	2·30	..	2·30	..	2·30
Consumption tax	11·00	..	13·00	..	13·00
Normal inland price	27·54	..	28·80	..	28·80
Actual price	28·71	..	35·25	..	35·25
Artificial extra-value	1·17	..	6·45	..	6·45

"We see then that the 'Kartell' tends to keep up a constant artificial margin of fl.6·45 (fr.13·54) per 100 kilos. of refined between the quotations for the foreign market and those for the inland market. Of this margin a portion is used to secure to the raw sugar manufacturer an average price of fl.15 per 100 kilos. of raw sugar, the remainder goes into the pocket of the refiner. With the aid of this supplementary profit and the bounty on export, the Austro-Hungarian refiner is able, not only to maintain his position, but also to gain ground in the foreign markets, as is clearly shown by the statistics of the five last years, during which the exports of Austro-Hungarian sugar have gone up from 375,076 tons to 460,154 tons, a net gain of more than 18 per cent."

"Since the imposition of countervailing duties on bounty-fed sugars entering the United States, Austria-Hungary has been seeking outlets in Asia, the Far East and Japan. Notably, her exports to the East Indies have for some years sensibly increased. From 4,100 tons of refined in 1895 and 1,125 tons in 1896, they have risen to 41,002 tons in 1897 and 50,049 tons in 1898. But it may well be that these imports will be hampered by the compensatory duties recently enacted by the Indian Government. The question is whether the indirect premium of the 'Kartell,' which is not countervailed, will enable them to pass this barrier."

Mr. Dureau proceeds to point out that the success of the "Kartell" in Austria-Hungary could not fail to set the German manufacturers and refiners thinking whether they could not adopt similar measures, and, after a description of what is on foot in Germany, which it is not necessary for us to reproduce after what we have already given above, he closes by remarking that we cannot shut our eyes to the fact that it is not by entertaining such ideas and with such a programme, which, *de facto*, means the creation of indirect bounties, that Germany and Austria will render the task of the next Conference for the Suppression of Bounties any easier.

BELGIUM.

Sugar Manufacturers and Refiners.

A correspondent of the *Centralblatt für die Zuckerindustrie* says:—It is reported that negotiations are in progress between the leading sugar manufacturers of Belgium and the Raffinerie Tirlemontoise for participation as far as possible in the latter undertaking by all the sugar factories in the kingdom. As yet nothing authentic is known, but judging by an anonymous circular, signed "Un fabricant de sucre," the idea is to found a co-operative society, in which the refinery and the raw sugar manufacturers will participate in a fixed proportion. The raw sugar manufacturers will have to deliver to the refinery all the duty free sugar (that which is destined for consumption) for which they will receive the market price and the amount of the duty, after deduction of the so-called premium, and also a share of the profits of the refinery, if any have been made up to the close of the year.

The anonymous author of the circular is evidently no great friend of the project. On the contrary, he draws up the following division of the profits, adopting the as yet unproved assertion that they will amount to not less than 800,000 frs.:—

	Francs.	Profits. Francs.
		800,000
Deduct reserve fund 5 %	40,000	
Interest and sinking fund of the capital of frs. 6,000,000	400,000	464,000
4 % interest on the paid in frs. 600,000 of the called up capital of frs. 3,000,000..	24,000	
		336,000
Deduct for expenses of management		33,600
		302,400
Deduct for providing an extra reserve fund, one-third of the above sum		100,800
Remainder......................		frs. 201,600

The above sum is what is to be divided among the companies of the second group in proportion to the sugar delivered. But if the quantity delivered amounts to 201,600 sacks of 100 kilos. each, this comes to one franc per sack. To attain this meagre result, the manufacturers

must pay up three millions of francs, and tie the hands of themselves and their successors for thirty years, and in addition guarantee interest and sinking fund to the extent of six millions, not reckoning the 2½ francs per sack to be paid to the refinery as premium. If the Belgian sugar legislation should be altered in the direction indicated in former articles, the affair would turn out still more unfavourably for the sugar manufacturers.

SACCHARINE *v.* SUGAR

(From the *Centralblatt für die Zuckerindustrie.*)

SACCHARINE IS NOT AN ARTICLE OF FOOD, AND ITS USE HAS BEEN TO A LARGE EXTENT PROHIBITED.

The German imperial law of 1st October, 1898, prohibited the use of saccharine for the industrial production of beer, wine, etc. This prohibition applies also to all artificial sweetening substances, such as zuckerine, sykose, crystallose, dulcine, glucine, and the like. The legislation of other countries has advanced further in respect to the accurate perception of the nature of artificial sweetening substances.

Belgium has prohibited the importation, manufacture, and sale of saccharine and analogous substances, and makes an exception only where these substances are imported by pharmaceutical chemists for medicinal use.

France prohibits the importation of saccharine and similar sweetening substances, and their use in articles of food.

Great Britain prohibits the use of saccharine in the manufacture of beer.

Italy prohibits importation and manufacture of saccharine, and products containing saccharine, and permits only the importation for medicinal use.

Austria-Hungary prohibits unconditionally the importation of artificial sweetening substances, allowing only the importation of saccharine for medicinal purposes; in that country also the employment of artificial sweetening substances in food is prohibited.

In Spain the importation of saccharine and of any substances containing saccharine as articles of food is prohibited.

The same is the case in Portugal, where an exception is made in favour of apothecaries.

In Russia the use of saccharine is absolutely prohibited, and is only permitted for medicinal purposes, in which case special permission to import has to be obtained.

The French Officer of Public Health has declared that saccharine disturbs the digestive organs. Saccharine, and food stuffs containing saccharine, must therefore to be excluded from daily food. Other medical authorities are also of the opinion that saccharine should not be used as food by healthy people.

Sugar is an Article of Food and a Producer of Energy.

Sugar, which is everywhere esteemed as a delicacy, possesses also special importance as an article of food. Modern medical science has specially emphasized the high nourishing value of sugar and the part it plays in the supply of muscular energy. Moreover, the quick and easy digestibility of sugar, on the one hand, does not overburden the stomach and digestive organs; and, on the other hand, is unsurpassed as an agent for the quick evolution of energy. The high nutritious value of sugar should especially be taken into account along with its cheapness. Sugar as an article of food is essentially cheaper than preparations of albumen. Sugar must be assigned a prominent place as a food stuff, especially as an article of food for children and such persons as are compelled to work hard. For great physical efforts such as are required in the exercise of any sport, sugar ought to be strongly recommended—the more so as it is particularly instrumental in appeasing the feeling of thirst. The importance of sugar in diet proceeds from its easy digestibility, its power of quickly replacing spent energy, and its antiseptic action. In short, sugar nourishes and strengthens, appeases hunger and thirst, hardens the muscles, strengthens the weak, and is beneficial to invalids. Sugar is a food for the people.

We would call attention to an article, commenced in the present number, on page 317 by Mr. H. C. Prinsen Geerligs, on "Crystallisation in Movement."

The rumours respecting a probable re-assembling, during the present year, of the Brussels Conference on the International Suppression of Bounties, are taking more definite shape, and we may have something to report on this subject in our next number, though we think it is growing rather late for the meeting to be arranged for this year.

GOLDEN SYRUP.

By Sigmund Stein.

Manager, Crosfield, Barrow & Co., Sugar Refiners, Liverpool.

Third Article.

At the meeting of the International Congress of Applied Chemistry held in Vienna on the 29th July, 1898, the molasses question was discussed.

Professor F. G. Wiechmann, of New York, referred to the crystallisation of amorphous saccharose and mentioned a series of experiments under conditions in which saccharose changes from the amorphous state to the crystallised form. The quantity of invert sugar present was found by the experimenter to have a great influence in this respect. In all cases where crystallisation took place the content of invert sugar was lower than with sugars which did not crystallise. Crystallisation first took place in sugar having the lowest content of invert sugar, and afterwards in proportion as the latter increased.

Light was also found to have great influence on crystallisation and Wiechmann established the fact that the latter was accelerated by the action of light.

(I may mention in connection with this subject that I have made experiments by keeping several samples of syrup in darkness for a considerable time, while other samples of the same lots and analyses were exposed to the light. The samples kept in darkness were found to be perfectly bright, and no signs of crystallisation could be noticed, while those exposed to the light became cloudy after several weeks' exposure, and afterwards gave indications of crystallisation, and within five or six weeks crystallised sugar could be distinctly noticed in the syrup.)

At the same meeting of this Congress, A. Aulard referred to the molasses co-efficient of raffinose. This co-efficient was given by Lotman as 5, and by Hempel at 2·82. Herzfeld thinks that the molasses co-efficient of raffinose is not necessary, and that all that is needful is to correct the polarisation. He also says that raffinose does not form any more molasses than other non-sugars, and that raffinose must not be compared with invert sugar.

Sachs also thinks raffinose less injurious as regards the formation of molasses than the invert sugar.

Herzfeld found that small quantities of raffinose diminished the capability of keeping sugar in solution, whereas larger quantities increased it. He also says that it may be assumed that one part of raffinose prevents the crystallisation of 1·5 part of saccharose, but this theory is contradicted by Aulard, who comes to the following conclusions :—

1st. Raffinose has a beneficial influence on the crystallization of saccharose.

2nd. Irregular crystallisation is not dependent on the presence of salts, but arises from the influence of the viscosity, which is due to the great quantity of organic substances.

3rd. In abnormal products the saccharose is present in comparatively smaller quantities than in normal products.

Aulard does not admit Herzfeld's statement that 1 part of raffinose prevents the crystallisation of 1·5 part of saccharose, and says that raffinose does not injuriously affect such crystallisation. Raffinose is a body which is not very apt to crystallise, and is to be found in molasses, which contain raffinose, saccharose, salt and a great quantity of organic and inorganic matters. Aulard also indicated the influence that maltose and glucose have on after-products. He added to molasses, which were not capable of crystallisation, 10, 15, 20, 25 and 30 per cent. respectively of maltose and glucose syrup, and after a short time the saccharose in this mixture crystallised and settled down as an impure product which he afterwards rendered pure by successive washings with alcohol.

In this case the maltose and glucose had the same effect on the sugar solution as raffinose, because these reducing sugars are anti-molasses-forming and take the place of saccharose in sugar solution.

From further experiments Aulard clearly established that glucose (dextrose and levulose) and invert sugar, which are present in cane sugar products, are all formed in the process of manufacture, and take the place of saccharose in the last products of sugar manufacture.

It is interesting to notice, that Pellet came to the same result in his investigations on the analysis of beet and cane sugar molasses. He says that the reducing sugars do not prevent crystallisation but on the contrary favour it because they diminish the proportion of the viscosity in the total mass of the sugar. Aulard and Pellet come to practically the same interesting conclusion.

According to Pellet's investigations, the viscosity of cane sugar molasses, compared with that of beet sugar molasses, is as 0·57 to 2·81.

It cannot be wondered at that products stated to be uncrystallisable—such as products which have been mixed with glucose—are still found to be crystallisable and, as Aulard shows in his tabulated report, the products of cane sugar manufacture with a purity of 41·86 and containing 35·57 reducing sugar, 6·39 salts, and 14·18 organic substances, will crystallise if from 8 to 9 per cent. of water are added. Syrups with the following analysis:—purity 44·164, reducing sugar 20·406, salts 10·11, and organic substances 25·30 can also be crystallised under the same conditions.

Weisberg mentions that the crystallisation of sugar in molasses is only a question of time. He found after a great many experiments that sugar dissolves in molasses the same as in pure water.

The prevention of crystallisation is to be attributed more to physical effects and to the viscosity rather than to the influence of non-sugar. The latter view is contradicted by Claassen.

Dr. von Lippmann issued a caution against fixing or describing "normal molasses," which he said did not exist.

Herzfeld declared that the molasses-forming influence of non-sugars was found by him to be comparatively weaker at high than at low temperatures.

Apropos of this short résumé of the proceedings with reference to molasses at the International Congress, I may remark in conclusion that I have for a considerable time been conducting experiments under the following conditions:—

1st.—The influence of glucose and maltose on raffinose in cane sugar molasses.

2nd.—The influence of the proportion of the said sugars to the saccharose.

3rd.—The influence of concentration on molasses.

4th.—The influence of light on molasses.

5th.—The influence of heat on molasses.

6th.—The influence of the organic and inorganic non-sugars.

7th.—The influence of physical conditions and viscosity.

These investigations are not at present complete, but a report of the result will be laid before the next International Congress of Applied Chemistry, to be held in Paris in the year 1900.

JAVA.

The "Algemeen Syndicaat van Suikerfabrikanten op Java" (General Syndicate of Sugar Manufacturers in Java), held its annual Conference from the 6th to the 8th March, at Bandong, in the Western portion of the island.

The Chairman, Mr. 's Jacob, read the annual report, which gave a summary of whatever was noteworthy that had taken place during the year. Among a great deal of matter of purely local interest, he stated that the experiments made with mutual control of the technical work in the factories had been attended with complete success, so that steps are being taken to extend the system to all the factories belonging to the Syndicate. A report was next read from the commission charged with examining in what way the two existing experiment stations at Kagok and Passoeroean and the publication or review, "Archief voor de Java-Suikerindustrie," could be placed under the control of the Syndicate. The Commission recommended the buying-up of these undertakings, but it is more than doubtful whether the boards of direction of these thriving independent institutions, which up to now have managed remarkably well, will be found willing to part with them.

After these official communications, several papers were read, the contents of which may be summed up as follows:—

Kobus delivered an address on the present state of the problems connected with manuring in Java. Numerous well conducted field experiments have shown that under the special circumstances of cane cultivation in Java, potash and phosphoric acid have no value at all as cane fertilisers. Cane is exclusively planted on land on which wet paddy has been grown for two years successively; the planters only reverting to cane on the same field every third year. Now, during the growth of the two rice crops, the field is overflown with volcanic river silt, which brings more potash and phosphoric acid on to the land than can be taken up with a cane crop, thus saving the planter the trouble of restoring them in manure. Only nitrogenous manure proved successful and absolutely necessary for obtaining large sugar crops. The sulphite of ammonia is a more economical fertiliser than oil cake because the nitrogen is cheaper, and, moreover, more easily taken up by the plant.

Van den Brandeler reviewed the various systems of green bagasse firing in use in Java, and recommended a system, which he

explained by means of drawings, enabling planters to obtain all the steam they want in the entire sugar house from the green bagasse only, without any additional fuel.

CARP spoke on a new formula for the calculation of the available sugar in the juice. The old Stammer formula, which had been in use up to now, had become obsolete owing to the improved methods of sugar making, and so it was necessary to adopt a more scientific formula. Carp assumes a proportion of 4 per cent. for all mechanical and chemical losses, except those in the bagasse and the molasses. The loss of sugar in the bagasse is determined in another way, and does not appear in the formula. Experience showed that molasses may be considered as exhausted when their quotient has fallen as low as 30°, and so, taking into consideration the quality of the sugar made, the formula now becomes:—

$$\left.\begin{array}{r}\text{Available sugar per}\\ \text{100 parts of juice}\end{array}\right\} = \frac{\text{Quotient of mill juice} - 30}{\text{Quotient of sugar} - 30} \times \frac{(100\text{-}4)\text{ pol. juice.}}{\text{Quotient of juice.}}$$

PRINSEN GEERLIGS raised the question of what to do with the exhausted molasses. They might be used for "Entzuckerung," for distilling, as food for cattle and horses, or as fuel. Every attempt to gain the sugar still present in the molasses has failed, the market for arrack or alcohol is already overcrowded, unless the use of incandescent spirit lamps should increase, now that the invention of transportable mantles is bringing this light within the reach of everyone, even in the most remote outposts. The cattle do not belong to the manufacturers, and it is not likely that the native cattle owners will adopt any suggestions for feeding their stock on molasses. Burning the molasses as fuel in special furnaces has, however, proved feasible, and in this way the calorific effect of the molasses of a factory is calculated at about one-tenth of that of all the green bagasse yielded by the same amount of cane. The ash, which is rich in potash, is an excellent manure for tea or coffee plants.

SAX and PRINSEN GEERLIGS communicated details of their experiments with crystallisation in movement, and though they had worked quite independently of each other, their conclusions were almost identical. They found it possible to separate the masse-cuite by one operation into good sound sugar and molasses with a quotient of 40 to 45. After this molasses has been once more boiled and allowed to crystallise, it yields a further quantity of sugar, the so-called sack sugar or black stroop, and an exhausted molasses with a quotient of about 30.

ARENSEN HEIN read a paper on the best construction of vacuum-pan, which he preferred with a large diameter, low in height, and with a considerable horizontal distance between the steam coils.

MULDER mentioned the results obtained with other cane varieties than the ordinary Cheribon, or Black Java cane. He strongly recommended the Lousiers cane for loose, sandy soils.

MULLER VON CZERNICKY and DELFOS read papers on the best construction of cane-mills, and the most economical way of working them.

TRINIDAD.

At the meeting of the members of the Royal Colonial Institute, held in April last, an instructive and interesting paper was read by Sir William Robinson, G.C.M.G., lately returned from Hong Kong, who had an experience of eighteen years as Governor in the West Indies, on "Trinidad: its Capabilities and prominent Products." The lecturer alluded to the successful production for a long series of years of sugar, which *was* and perhaps still may be considered the leading cultivation, and referred as under to the other productions of this very fertile island, which may be expected, under the ægis of Dr. Morris, and the care of Mr. J. H. Hart (the latter, for many years, has ably superintended the Botanical Gardens), to assume much greater prominence in the future:—"The soil possesses wonderful fertility and is diversified in its nature. The sugar estates have an area of about 66,480 acres. Cocoa, which is pressing very hard upon the heels of the sugar cane, thrives admirably in nearly every quarter of the island, and Trinidad cocoa is famous all the world over. Then limes, cocoanuts, mangos, and every other conceivable tropical fruit and tropical vegetable, flourish in extraordinary abundance wherever cultivated. These fruits and vegetables, however, as yet are insufficient to supply local demands. As a matter of fact, Trinidad is still dependent to some extent on imported vegetables and other food supplies. It is thus compelled to pay away annually to strangers large sums of money for what could profitably be grown in its own fields. It relies upon Venezuela for its plantains, and the value of fruits and vegetables imported into this prolific island so lately as 1896 amounted to £30,000."

We have received Mr. Hart's report of the operations at the Royal Botanical Gardens during 1898, and shall notice it at length in our next issue.

THE STATISTICAL ASPECT OF THE SUGAR QUESTION.

In our May number we gave a very cursory and imperfect résumé of the paper with the above title, by Mr. Martineau, which was read at a meeting of the Royal Statistical Society on the 13th April last. In view of the great interest and value of such a paper, by probably the best authority on the knotty problems connected with the sugar question which have sprung up during the last thirty years and to a large extent remain unsettled, we thought it advisable to apply to the Council of the Royal Statistical Society for permission to reproduce the paper in full. We are informed that such permission has never yet been granted, as the papers appear in extenso in the *Journal of the Royal Statistical Society*, published quarterly at 9, Adelphi Terrace, Strand, London, W.C., but, under the circumstances, we are very courteously allowed to give copious extracts, and very gladly take advantage of this kind permission.

The object of the paper, as stated at the outset, is to treat from the statistical point of view the various phases connected with the subject of the increased production of beetroot sugar, stimulated, as is alleged, by bounties. To put the comparative positions of the production of cane and beet sugar clearly before his hearers, Mr. Martineau gave the following table:—

	Visible Production of Cane Sugar. Tons.	Production of Beetroot Sugar. Tons.	Total. Tons.
1872	1,850,000	1,143,000	2,993,000
1882	2,116,000	1,783,000	3,899,000
1892	2,784,000	3,501,000	6,285,000
1897	2,310,000*	4,916,000	7,226,000

* * * * * * * * * * * *

From this table it is clear that the world has now become dependent on tho European beetroot crop for nearly two-thirds of its total visible supply of sugar, and that the supply of sugar and its price are therefore largely governed now by the vicissitudes to which that crop may be subject.

I.—Production of Beetroot Sugar.

1. *France and Germany: a Contrast.*

Turning to the details of the beetroot industry, let us look first at the yearly production of France and Germany from the season of 1871-72 to that of 1884-85.

* The decrease here is attributable to the Cuban insurrection.

Season.	French Production. Tons.	German Production. Tons.
1871-72	287,444	186,442
1872-73	350,271	262,551
1873-74	339,925	291,040
1874-75	386,467	256,412
1875-76	396,222	358,048
1876-77	208,539	289,422
1877-78	341,256	378,009
1878-79	370,831	426,155
1879-80	238,210	409,415
1880-81	283,602	555,915
1881-82	307,088	599,722
1882-83	362,737	881,995
1883-84	406,007	940,109
1884-85	272,962	1,123,030

Here we are at once struck with the fact that in France, originally the foremost of all the European sugar producing countries, while in 1871-72 her production was 287,000 tons, 100,000 tons more than the German production, in 1884-85 it was no more than 272,000 tons. It had never risen during that period of fourteen years above 406,000 tons, and the average for the fourteen years was only 325,000 tons. In Germany, on the other hand, we find that the production, which in 1871-72 was only 186,000 tons, had risen in the fourteen years to 1,123,000 tons in 1884-5, and that the average production for that period was 497,000 tons.

How is it that, starting at a point considerably behind France, Germany should have so completely distanced her in fourteen years? If we look at the legislation of the two countries we find, I venture to think, a sufficient explanation.

In France, up to 1884, the beetroot factories were subjected to the strictest excise supervision, so that not an ounce of sugar was allowed to escape. The duty was levied on the sugar as it passed into home consumption; no drawback was therefore necessary on exportation, and there was no opportunity for a bounty.

In Germany the system was exactly the reverse. The duty was levied on the weight of the roots, according to an estimated yield of sugar; and as the quantity of sugar actually produced exceeded the quantity on which the duty was levied, a portion of the production escaped the tax. This system was deliberately adopted in order to

stimulate improvements in cultivation and manufacture, and it thoroughly answered its purpose. Roots which at one time yielded only 5 or 6 per cent. of sugar were gradually improved by careful selection until, as time went on, they yielded 8, 9, then 10, 11, and, finally, at the present day, 12 to 13 per cent. At the same time the processes of manufacture were brought nearer to perfection, so that now almost all the sugar contained in the roots is successfully extracted.

The producer thus responded heartily to the stimulus of the fiscal system, and he reaped his reward. As the full duty was returned in drawback on the sugar exported he had no fear of overloading his home market, and therefore went on increasing his cultivation and the size of his factory without hesitation, the profits of the constantly increasing bounty keeping him well supplied with capital for the necessary outlay.

I give the figures of the yield of sugar, per 100 of roots, in Germany, year by year, from 1871-72 to 1884-85. It is sufficient to compare the yield in France towards the close of the period. Germany at the beginning of the period had already been many years under the system of duty on the roots, and therefore her yield, even so far back as 1871-72, is better than that of France in 1884-85:—

	Yield of Sugar in Germany. Per cent.	Yield of Sugar in France. Per cent.		Yield of Sugar in Germany. Per cent.	Yield of Sugar in France. Per cent.
1871-72....	8·28	—	1878-79....	9·30	—
1872-73....	8·25	—	1879-80....	8·64	—
1873-74....	8·25	—	1880-81....	8·89	—
1874-75....	9·30	—	1881-82....	9·69	5·10
1875-76....	8·60	—	1882-83....	9·65	5·03
1876-77....	8·19	—	1883-84....	10·77	5·55
1877-78....	9·29	—	1884-85....	11·02	5·99

The German yield went up from 8·28 per cent. in 1871-72 to 11·02 per cent. in 1884-85, while the French yield remained below 6 per cent.

Thus we see a striking contrast. France, with no bounty, made little progress in cultivation and manufacture. Her roots remained poor, her methods more or less behind the times, and her production almost at a standstill. Germany, in 1884-85, had nearly doubled the French yield, and in fourteen years had multiplied her own production by six.

As we continue the history of these two countries from the point now reached, 1884, to the present time, we again find the figures faithfully indicating the fluctuations in legislation.

It was in 1884 that the German producer began to feel the inevitable effect of his over production on the world's price of sugar. In that year the price went down to the lowest point ever known, and then fell to half that price. You will see the result—a reduction in the German production from 1,123,030 tons in 1884-85, to 838,104 tons in 1885-86, which, I may mention incidentally, sent up prices from 10s. 3d. to 16s. 9d. per cwt.

In this same year, 1884, France took a new departure. There had been a serious crisis in the sugar trade, owing to the over-loaded stocks and the consequent great fall in price, and it became evident that the French beetroot sugar industry could no longer compete if it remained under a *régime* which secured every franc for the revenue and left nothing for the producer. By the French law of 1884, therefore, the German system was established in France, and the French producer at last enjoyed a bounty. The incidence of the duty was transferred from the actual sugar to the roots. All the pains that had been taken, by the strictest excise supervision, to ascertain the exact quantity of sugar produced, though still continued, were made of no effect, in order that the producer might have the same stimulus that had led to such successful results in Germany. Though the sugar produced continued to be accurately noted, he was no longer charged with duty on the actual quantity but on a fictitious figure, known to be much less than the real production. He received what was equivalent to a drawback on exportation to the amount of the full duty, so that he was always able to reduce his supply for the home market to the requirements of the French consumption, and thus to obtain the full duty on the whole of his production. He was not only presented with a large bounty, but stimulated to make it larger every year. The French yield was, as you have seen, very small when this change was made in 1884, and consequently the estimated yield on which to level the duty was fixed at a considerably lower figure than that in force in Germany at the same period. It took some years, of course, for the French producers materially to increase the yield of their roots and the efficiency of their machinery, but, as you will see by the figures, the improvement gradually came.

A comparison of the production in France and Germany, during the period of the newly created French bounty, with the yield in the two

countries, gives a very different picture to that of the previous table. France jumps at once from an average yield of 5½ per cent. to 7·83 per cent., and steadily increases up to 11·40 per cent., while her production rises from 265,000 to 730,000 tons.

Season.	French Production. Tons.	German Production. Tons.	French Yield. Per cent.	German Yield. Per cent.
1885-86	265,071	838,104	7·83	11·43
1886-87	434,043	1,018,281	8·86	11·87
1887-88	347,785	958,863	9·53	13·08
1888-89	414,869	090,891	9·77	11·96
1889-90	700,400	1,261,353	10·47	12·36
1890-91	615,958	1,336,221	9·46	12·00
1891-92	579,420	1,198,025	10·26	12·06
1892-93	523,366	1,230,834	9·56	11·94
1893-94	514,788	1,366,001	9·80	12·34
1894-95	704,454	1,827,973	9·87	12·15
1895-96	593,646	1,637,057	10·97	13·11
1896-97	668,516	1,121,223	9·98	12·66
1897-98	730,067	1,844,399	11·40	12·79

Even in 1889-90 the French had increased their production, in spite of a much lower range of prices than those which ruled prior to 1884, to 700,000 tons. This was a good increase, and would no doubt have been maintained had not the government found that they were losing too much revenue by the enormous bounty they had created. Changes were made in 1887 and 1890, which compelled the manufacturers to increase their yield if they were to maintain the amount of their bounty. The legal yield was raised, and the excess yield, instead of being admitted free, was charged with a portion of the duty. At that time they had not succeeded in overtaking the German yield, but they made fresh efforts, with such success that at the present moment there is not much more than 1 per cent. difference between the yield in the two countries. This again increased the bounty, and the result is again faithfully reflected in the figures.

The German Government, in the meantime, had come to the conclusion that their producers had arrived so nearly at perfection that no further stimulus was necessary. While France had given up the accurate levying of the duty in order to give a bounty by the German system, the German Government, in 1888, proceeded to take the opposite course, and gradually to abolish the bounty by establishing excise supervision and levying the duty on the actual

sugar. But though they completely abolished the indirect bounty in 1892, they did not allow the vast sugar industry they had helped to create to suffer from the competition of the new French bounty or of the bounties in other countries. A direct bounty was therefore substituted for the indirect one, but with the distinct announcement that it was only to remain in force until a general agreement for the abolition of bounties should be arrived at.

This direct bounty was to have been gradually reduced, but in the meantime the French production, as I have described, was making such progress that the German Government decided, in 1896, to double their direct bounty instead of reducing it. They saw that France, with its new bounty, meant to fight hard for supremacy, and they openly declared this double bounty to be "a war bounty." France lost no time in responding, and, in 1897, added to its enormous indirect bounty a direct bounty equivalent to the doubled bounty in Germany.

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The exact amount of the French indirect bounty can be stated, because the excise supervision, though no longer required for the assessment of duty, was retained for the special purpose of ascertaining the annual amount of the bounty. This was necessary, because the law of 1884, which established the bounty, provided that the sugar-producing French colonies should receive each year the same bounty on the sugar they sent to France as the beetroot producers had secured in the previous season. Thus, if it was found that in one season the beetroot producers had succeeded in getting 20 per cent. of their production assessed at the reduced duty, then the French colonies were to be allowed, in the following year, to introduce into France a similar proportion of their imports at the reduced duty.

The official statement of the French indirect bounty for 1897-98 is as follows:—

"The net excess yield at the reduced duty represents for the past "season, 1897-98, 28·002 per cent. of the production, against 21·61 "per cent. in 1896-97. The colonial allowance will therefore be "28,002 per cent., against 21·61 per cent. The yield of the beetroot "comes out at 11·40 per cent. in refined, including the sugar in the "molasses, against 9·88 per cent. in 1896-97."

The official figures of this bounty, in francs, for each year since its creation in 1884, are as follows:—

Official Statement of the Amount of the French Indirect Bounty from 1884-85 to 1896-97.

[Report of the Senate Commission, 17th March, 1897, p. 79.]

	Francs.		Francs.
1884-85	25,364,177	1891-92	46,661,271
1885-86	45,448,944	1892-93	38,019,319
1886-87	91,966,437	1893-94	38,819,724
1887-88	68,438,704	1894-95	51,222,651
1888-89	56,744,468	1895-96	54,138,301
1889-90	90,977,833	1896-97	57,577,968
1890-91	44,025,252		

The effect of the changes in the law in 1887 and 1890 is clearly indicated. In both instances the bounty had risen to 90 millions, and fell immediately to 68 and 44 millions.

I cannot give the total indirect bounty for 1897-98, not having yet seen the figures for the colonial sugar. But the total indirect bounty on the beetroot production alone is 61,320,594 francs, calculated as follows (1897-98): Total production, 730,007,082 kilos.; excess yield at reduced duty, 204,414,374 kilos.

$\frac{204{,}414{,}374 \times 100}{730{,}007{,}082} = 28{\cdot}002$ excess yield per cent. of total production.

The duty is 60 frs. per 100 kilos., and the duty on the excess yield is only 30 frs. The gain on the excess yield is therefore 30 frs. per 100 kilos.

$\frac{28 \times 30 \text{ frs.}}{100} = 8{\cdot}40$ frs. bounty per 100 kilos. of sugar produced.

$7{,}300{,}070{\cdot}82 \times 8{\cdot}40$ frs. $= 61{,}320{,}594$ frs., indirect bounty on the crop of 1897-98.

The bounty per 100 kilos. of the excess yields, the excess yields per cent. of the production, and the corresponding bounty per 100 kilos. of the total production are given as follows:—

Season.	Bounty per 100 kilos. of Excess Yield. Francs.	Excess Yield per Cent. of Total Production.	Bounty per 100 kilos. of Total Production. Francs.
1884-85	50	14·520	7·26
1885-86	50	29·400	14·70
1886-87	50	36·440	18·22
1887-88	50	27·240	13·62
1888-89	40	26·190	10·47
1889-90	40	28·540	11·41
1890-91	30	19·350	5·80

Season.	Bounty per 100 kilos. of Excess Yield. Francs.	Excess Yield per Cent. of Total Production.	Bounty per 100 kilos. of Total Production. Francs.
1891-92	30	23·830	7·15
1892-93	30	19·470	5·84
1893-94	30	21·180	6·35
1894-95	30	21·730	6·52
1895-96	30	26·880	8·06
1896-97	30	21·610	6·48
1897-98	30	28·002	8·40

*   *   *   *   *   *

It is impossible to give such accurate or authoritative figures of the German indirect bounty. We have, however, the materials for a calculation. From 1869 to 1883 the duty per 100 kilos. of roots was 1·60 marks, and the drawback per 100 kilos. of raw sugar was 18·80 marks. If the roots yielded 8½ per cent. of raw sugar this drawback would be about correct. As soon as the yield rose above 8½ per cent., the bounty began. The following statement and calculation, for which I am indebted to M. Dureau, the eminent specialist and editor of the *Journal des Fabricants de Sucre*, gives a very clear idea of the progress of the German bounty :—

Season.	Roots per 100 Kilos. of Sugar. Kilograms.	Duty per 100 Kilos. of Roots. Marks.	Drawback per 100 Kilos. of Sugar. Marks.	Bounty per 100 Kilos. of Sugar. Marks.	Real Yield per Cent. of Roots.
1871-72	1,207	1·60	18·80	—0·512	8·28
1872-73	1,211	1·60	18·80	—0·576	8·25
1873-74	1,212	1·60	18·80	—0·592	8·25
1874-75	1,075	1·60	18·80	+1·600	9·30
1875-76	1,162	1·60	18·80	+0·208	8·60
1876-77	1,220	1·60	18·80	—0·720	8·19
1877-78	1,075	1·60	18·80	+1·600	9·29
1878-79	1,076	1·60	18·80	1·584	9·30
1879-80	1,157	1·60	18·80	0·288	8·64
1880-81	1,122	1·60	18·80	0·848	8·89
1881-82	1,031	1·60	18·80	2·304	9·69
1882-83	1,036	1·60	18·80	2·224	9·65
1883-84	928	1·60	18·00	3·152	10·77
1884-85	907	1·60	18·00	3·490	11·02
1885-86	844	1·60	18·00	4·496	11·83
1886-87	816	1·70	18·00	4·128	12·25
1887-88	726	1·70	17·25	4·908	13·70
1888-89	797	0·80	8·50	2·124	12·54
1889-90	779	0·80	8·50	2·268	12·83
1890-91	797	0·80	8·50	2·124	12·54
1891-92	791	0·80	8·50	2·172	12·64

From 1871-72 to 1876-77, with exception of the seasons 1874-75 and 1875-76, the yield kept slightly below 8½ per cent., and there was no bounty. If you refer to the table of German production you will see that there was no marked increase until after that period. When we come to the period from 1877-78 onwards, we see the progress of the bounty from 1 mark up to nearly 5 marks per 100 kilos., and the production goes up from under 400,000 tons to over a million.

Mr. Martineau remarks that he has checked the calculations of Mr. Dureau by a different method of working, and found the results to agree very fairly with those above given.

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From 1892 the whole duty was levied on the actual sugar, and a direct export bounty was given of 1 mark 25 per 100 kilos. on raw, and 2 marks on refined sugar. This was raised in 1896 to 2 marks 50 on raw and 3 marks 55 on refined.

This is a bounty of 1s. 3d to 1s. 9d. per cwt. given on exportation; but to the producer it amounts to a bounty of the same amount on his total production, because it is evident that he will not sell his sugar at two prices. Whatever prices he gets for export he will charge also to the home consumer. If he gets in the English market 11s. per cwt., free on board Hamburg, for his refined sugar, he receives 11s. plus 1s. 9d. bounty. Therefore he will certainly not charge less than 12s. 9d. for similar sugar sold to the home consumption, apart from the duty and from any further increase of price he may obtain by combination, which is always possible where outside sugar is more or less excluded by a wall of protection. We shall come to the consideration of this influence when we deal with the Russian industry.

A bounty on export is therefore obtained on the whole production. On the other hand, a bounty on production would gradually cease to be a bounty unless it were also obtainable on export, because it would eventually operate simply as a reduction of the duty on consumption. The producers would compete for the home market until they gave away all their advantage to the consumer. It is because the French indirect bounty is, as I have explained, obtainable on export, that it has been so completely secured by the producer on his total production. The combined direct and indirect bounties in France amount to at least 12 frs, per 100 kilos., or 5s. per cwt., as compared with 1s. 3d. to 1s. 9d. per cwt. in Germany. From this it is evident that if the war of bounties is to continue, Germany has more room than France for

further increase of bounty, especially as the duty on sugar in Germany is only 20 marks per 100 kilos., while in France it is 60 frs.

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2. Austria.

Leaving France and Germany for a time, the lecturer turned to the progress of sugar production in Austria, and gave the following two tables as illustrating what had taken place in that country :—

Production of Sugar in Austria-Hungary from 1871-88.

	Tons.		Tons.
1871-72	213,000	1880-81	511,000
1872-73	231,000	1881-82	438,000
1873-74	242,000	1882-83	492,000
1874-75	226,000	1883-84	470,000
1875-76	277,000	1884-85	653,000
1876-77	290,000	1885-86	370,000
1877-78	346,000	1886-87	550,000
1878-79	389,000	1887-88	400,000
1879-80	410,000		

Production of Sugar in Austria-Hungary after the creation of the Direct Bounty, 1888-97.

	Refined. Tons.	Raw. Tons.	Total. Tons.
1888-89	352,037	130,012	482,049
1889-90	520,119	162,662	682,781
1890-91	501,956	208,300	710,256
1891-92	485,480	234,772	720,252
1892-93	573,103	155,408	728,511
1893-94	658,214	100,020	758,234
1894-95	739,412	220,371	959,783
1895-96	645,383	61,109	706,492
1896-97	691,415	158,452	849,867

* * * * * *

Mr. Martineau showed that those tables indicated a very similar state of things to what had taken place in Germany, but the manufacturer in Austria had an even better chance of deriving special profits, owing to the peculiar manner in which the duty was levied. Consequently the exports show a considerable increase, because the drawback exceeded the duty more and more each year, and the revenue from sugar gradually dwindled until at last it became a minus quantity. The sugar duty actually became a loss instead of a gain to

the Austrian Treasury. The following figures illustrate this curious process :—

Season.	Gross Revenue. Florins.	Drawback on Exports. Florins.	Net Revenue. Florins.	Exports. Tons.
1867-68	7,368,276	1,805,117	5,563,159	23,497
1868-69	6,069,617	77,528	5,992,089	?
1869-70	9,011,797	4,742,147	4,269,650	65,556
1870-71	11,659,740	7,306,653	4,353,087	92,119
1871-72	9,977,212	5,817,097	4,160,115	62,332
1872-73	12,697,926	6,410,106	6,287,820	87,086
1873-74	10,095,558	7,152,491	2,943,067	63,163
1874-75	7,201,007	5,458,683	1,742,324	82,590
1875-76	9,337,435	9,472,991	− 135,556	126,556
1876-77	10,876,187	10,479,973	+ 396,214	144,656

This disappearance of revenue was corrected by the law of 1878, which, while retaining the vicious system of estimating the quantity of roots according to the supposed capacity of the apparatus, protected the Treasury by insisting on a minimum revenue, with a gradual yearly increase.

This seems at last to have considerably checked the bounty, as the following figures indicate :—

	Compulsory Net Revenue. Florins.	Exports. Tons.
1882-83	10,800,000	270,132
1883-84	11,200,000	239,932
1884-85	11,600,000	349,511
1885-86	12,000,000	188,141
1886-87	12,400,000	274,458
1887-88	12,800,000	177,014

This gave rise to loud complaints from those engaged in the industry. and consequently, at their urgent request, in 1888 the system of levying the duty on an estimated yield was abolished. The duty is now levied on the actual sugar as it enters into consumption; no drawback is necessary on exportation, and therefore the bounty from that source has ceased. Austria, like Germany, has substituted a direct bounty, until a general agreement to abolish bounties shall have been arranged. The direct bounty is 1 fl. 60 per 100 kilos. on raw sugar, and 2 fl. 30 on refined, equal to 1s. 4d. and 1s. 11d. per cwt. This bounty was considerably larger than the original German direct bounty, and is apparently rather larger than the increased bounty in Germany, but is not so in reality, because a maximum annual bounty was fixed at five million florins in 1888, and raised in 1896 to nine millions. As the manufacturers have always exported

so largely that the bounty received has exceeded the fixed maximum, they have had to refund a portion at the end of each year. They, however, enjoy a certainty of nine million florins per annum, which is quite sufficient to stimulate production. As the bounty on refined is very much too large compared with that on raw, it will be noticed that the increase in the production of refined is very striking.

The total production at the close of the indirect bounty period, when the bounty had almost, perhaps quite, disappeared, gradually sank from 600,000 to 400,000 tons. At the beginning of the direct bounty period it quickly rose to 700,000 tons, and then to nearly a million, while the portion which was refined rose from 350,000 to 740,000 tons.

Here, then, as in the case of France and Germany, fluctuations in bounty are well reflected in the figures of production.

3. Belgium and Holland.

The lecturer did not enter at any great length into the question of the production and bounties in the first of these two countries because no one can state the precise figures with any certainty. He stated that the manner of levying the duties, on the density of the roots, enabled a large part of the production to escape duty, but gave the following table and remarks:—

Year.	Production, Estimated by Density of Juice. Tons.	Imports. Raw. Tons.	Imports. Refined. Tons.	Exports. Raw. Tons.	Exports. Refined. Tons.
1883	106,586	16,974	6,921	95,643	9,653
1884	88,462	16,413	6,442	58,451	9,285
1885	48,420	14,104	2,748	62,138	8,759
1886	91,119	12,025	1,038	87,999	10,391
1887	93,571	13,692	650	94,837	16,731
1888	95,803	13,235	405	68,254	19,691
1889	173,042	11,922	402	153,288	22,560
1890	159,114	13,574	389	135,889	21,890
1891	140,376	12,718	410	108,634	24,677
1892	143,698	12,934	1,068	101,088	29,948
1893	188,326	10,970	830	170,066	38,171
1894	208,956	9,143	593	95,841	27,887
1895	182,247	9,858	518	124,006	48,234
1896	235,041	9,358	468	127,404	52,596
1897	212,040	9,768	377	179,042	56,985
Total	2,166,801	186,688	23,259	1,662,580	397,458
	2,376,748			2,060,038	

The total estimated production and imports amounted, in the last fifteen years, to 2,376,748 tons, and the exports to 2,060,038 tons, leaving only 316,710 tons, or 21,114 tons per annum for home consumption. The Belgian Government may well put the following footnote to the above table:—

"The figures relating to the production of sugar are approximative, "the duty being based on a presumed yield. For the same reason it "is impossible to indicate with precision the quantity of sugar "consumed in Belgium."

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The revenue is protected by a compulsory minimum annual revenue of fr. 6,000,000.

The Dutch system was much the same, but in 1897 it was abolished and replaced by excise supervision, the duty being levied on the actual sugar. Small direct bounties are now given, amounting in 1897-98 to 2,500,000 florins to the beetroot sugar manufacturers, and 500,000 florins to the refiners, and gradually declining to 1,700,000 florins and 250,000 florins in 1905-06.

The production for the last fourteen years is stated officially as follows:—

Season.	Production, according to the Density of the Juice. Tons.	Excess Yield. Tons.	Total Production. Tons.
1884-85	32,293	2,925	35,218
1885-86	18,883	2,851	21,735
1886-87	28,694	5,193	33,888
1887-88	30,066	5,231	35,297
1888-89	27,580	5,460	33,041
1889-90	46,510	10,464	56,975
1890-91	51,089	11,546	62,635
1891-92	31,244	7,873	39,117
1892-93	45,379	10,951	56,330
1893-94	49,994	11,916	61,910
1894-95	61,334	9,757	71,092
1895-96	77,388	12,786	90,175
1896-97	126,359	17,042	143,402
	Actual Production.		
1897-98	120,269	—	120,269

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Holland, in addition to being a producer of beetroot sugar, is, for its size, a large importer of raw sugar and exporter of refined. Up to

1897 the refiners enjoyed a considerable indirect bounty, similar to that obtained by the Paris refiners, owing to the yield of refined being incorrectly estimated.

The following table shows the imports of raw and exports of refined since 1883:—

Year.	Imports of Raw.	Exports of Refined.
1883	115,923	69,527
1884	123,586	88,745
1885	110,994	79,561
1886	87,014	74,183
1887	100,002	84,367
1888	98,916	82,724
1889	90,516	79,756
1890	111,032	102,338
1891	92,183	100,594
1892	115,968	111,172
1893	100,195	100,954
1894	106,336	104,059
1895	94,877	110,759
1896	67,110	123,819
1897	57,978	121,542

It was the existence of the Dutch sugar colonies, no doubt, which gave rise to the sugar refining industry in Holland. The industry continues, though the original reason for it has gone. The imports are now mostly beetroot from neighbouring countries, and these imports are gradually giving way to the increasing supply from the Dutch beet fields.

4. Russia.

On the more interesting subject of the sugar production in Russia, more interesting because of special features and rapidly increasing production, Mr. Martineau made the following remarks :—The Russian system at present in force deserves some attention. Formerly, when the sugar producers found themselves inconveniently burdened with a surplus stock, the paternal Government came to the rescue with a temporary export bounty, sometimes on both the European and Asiatic frontiers, at other times for the Asiatic frontier only. In 1887 the sugar producers endeavoured to do without Government assistance by forming a syndicate for the purpose of keeping up prices in the home market. But competition eventually defeated this effort in 1894. The manufacturers then asked for a permanent bounty similar

to those given to their neighbouring competitors in Germany and Austria. The Russian Government, though declining to accede to this request, undertook to do what the producers had failed to accomplish—keep up for them a sufficiently high price in the home market to enable them to continue their production and to make a handsome profit even if obliged to export their surplus production at a loss. The plan was arranged with much skill, and has been so successful that the Russian sugar producer is now as secure as if he received a direct bounty from his Government. Sure of a profit of 6s. to 7s. per cwt. on his total production, he has every inducement to increase it, and Russia has plenty of spare land suitable for the growth of sugar beet. The system is worth considering for a moment. The first thing necessary for such a scheme is a good high wall to exclude imports. It is there, and sufficiently high. To carry out the rest of the arrangement a special law was passed in 1895, in accordance with which the Council of Ministers determines for each year, (1) the quantity of sugar necessary for the home consumption; (2) the quantity of sugar to be kept in reserve in case prices should rise beyond the fixed limit; and (3) the fixed limit of price. Each manufacturer, whether he be great or small, is allowed to put 982 tons into the home market. Beyond that quantity he is obliged to put aside his proportion of the reserved stock. The balance beyond these quantities is divided in such a way that each manufacturer has the privilege of selling for home consumption a quantity *in proportion to his total production.* Any excess he must export, or pay double duty upon it. The maximum price fixed by the Russian Government for home consumption is, after deduction of the duty, nearly double the price in outside markets. As this maximum price is always maintained, the Russian manufacturers secure by Government assistance a profit of 9s. to 10s. per cwt. on the 500,000 tons which they sell for home consumption; and though each one naturally increases his production every year in order to secure a larger share of this profitable trade, they can afford to get rid of the extra 150,000 tons at cost price, or even at a loss of 1s. per cwt., and yet secure the enormous profit of 6s. to 7s. per cwt. on their total production. The question arises, Is this profit, which is thus secured to them by law, a State bounty? It is certainly an artificial stimulus to over production, with a compulsion to export the surplus.

If the arrangement were made final, each factory enjoying a fixed proportion of the home consumption without increase, there would

be no stimulus to over production, and the international objection to the system would be removed. New factories would then be limited to the requirements of increased consumption.

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The following table was given to show the progress of sugar production during 22 campaigns:—

	Tons.		Tons.		Tons.
1875-76 ..	159,002	1883-84 ..	308,922	1891-92 ..	485,664
1876-77 ..	207,527	1884-85 ..	343,294	1892-93 ..	399,480
1877-78 ..	173,675	1885-86 ..	475,668	1893-94 ..	578,469
1878-79 ..	181,835	1886-87 ..	425,054	1894-95 ..	537,306
1879-80 ..	205,481	1887-88 ..	389,009	1895-96 ..	679,471
1880-81 ..	203,110	1888-89 ..	465,082	1896-97 ..	635,552
1881-82 ..	261,043	1889-90 ..	403,052		
1882-83 ..	287,270	1890-91 ..	466,427		

CRYSTALLISATION IN MOVEMENT.

By H. C. Prinsen Geerligs, Kagok Tegal, Java.

In a previous publication* I have shown that, on cooling down in movement an impure masse-cuite, the yield of sugar obtained is much larger than when cooled at rest, owing to the formation of very minute sugar-crystals during the cooling at rest of such a viscous medium. These tiny crystals, or "false grain," are mixed up with the molasses, making them sticky and causing them to adhere to the sugar crystals, so that curing takes a long time and a large quantity of covering-water or steam. If, however, such an impure masse-cuite is kept in movement, the sugar crystallising out later does not form separate crystals, but deposits itself on those already existing, causing them to grow and develop, and leaving the molasses perfectly limpid and easy to be removed in the centrifugalling.

Now very pure masse-cuites (85 and upwards) contain, after being boiled, only so small a quantity of molasses that the later crystallising sugar does not interfere with the curing, and in this case crystallisation in movement does not improve the yield of sugar.

I have seen many instances of impure masse-cuites in which the water content could be reduced to such a degree, without impeding the circulation, that the quotient of the molasses existing between the crystals had fallen as low as 42.†

* *Sugar Cane*, 1897, p. 369. † *Sugar Cane*, 1895, p. 364.

If we were to try to evaporate a pure masse-cuite in one operation to the same quotient of the molasses, the mass would become too thick and would char, and consequently loss of sugar might ensue. We are, therefore, compelled to leave more water in the masse-cuite, drain off the molasses, evaporate them again, and so only after a series of operations obtain the sugar with which they can part. It is evident that if we could introduce some matter or other which would keep the masse-cuite in a liquid state without dissolving sugar, we should be enabled to continue the evaporation to such a point that the quotient of the molasses would be reduced to about 40. This can be effected by drawing into the pan molasses having the same quotient as that we want to obtain. These molasses keep the masse-cuite liquid, maintaining it in circulation, and even if they dissolve some sugar, this is again recovered on cooling, and if this cooling is effected in movement we have already seen that all this later crystallised sugar assumes a form which is most favourable for centrifugalling.

The only principle on which we can obtain all the available sugar from a masse-cuite in one operation is that of diluting it with molasses from a former operation, continuing the evaporation to a suitable point, and cooling down in movement.

It is evident that the circumstances will have to be modified according to the demands of practical working, but it has been proved to be feasible to separate, in one operation, a masse-cuite resulting from syrup with a quotient of 90, into raw sugar and exhausted molasses with a quotient of 30°. I do not recommend going so far as this, because the last particles of sugar crystallising out from so impure a mother-liquor are somewhat coloured, and so, from the fact of their forming the surface of the crystals, impart to these a dark colour, thus reducing the value of the sugar. I have found it more convenient to draw in only so much molasses and to evaporate only to such a degree that sugar polarising 97·5 is made and a molasses with a quotient of 40 to 45 is left. This molasses can be boiled once more to string proof, allowed to cool down for some months, and then be poured into bags made of matting, when the now exhausted molasses (quotient about 30) drains off, leaving behind the so-called "sack sugar," or black stroop, which is always sure to fetch a fair price here.

The best way of boiling is as follows: Syrup is boiled into masse-cuite in the usual way, taking care to fill the pan to only about two-thirds. The evaporation is stopped as soon as the density has attained about 90 Brix, after which hot molasses from a former opera-

tion are gradually drawn into the pan, and evaporation is continued until the mixture has a quotient of about 70 and a density of 94 to 95 Brix. The quantity of molasses is calculated according to the quantity of the original masse-cuite, its quotient and the quotient of the molasses being so regulated as to bring the quotient of the mixture to from 70 to 73. It is necessary to employ hot molasses, with a temperature of at least a few degrees higher than the contents of the pan, because by drawing in cold molasses a sudden fall in temperature might be caused, which would interfere with the proper course of crystallisation.

A few examples may here be given, in order to clearly explain the course of after-crystallisation.

After the pans had been struck into the vessels for the crystallisation in movement, samples of the contents of the latter were taken now and then and thrown into funnels of centrifugal wire-gauze. The molasses occurring between the crystals, which drained off, were collected and analysed, and showed the gradual course of the crystallisation.

I.

Syrup having the following analysis—Brix 45·58, polarisation 39·2, and quotient 86—was boiled into masse-cuite, the pan being only two-thirds filled. It was concentrated to 90 Brix. Molasses with a quotient of 41·4 were now gradually drawn in, and evaporation was continued until the mixture showed the analysis: Brix 94·44, polarisation 65·2, quotient 69·04.

This mixed masse-cuite was struck into the crystallisers, stirred for twelve hours, and centrifugalled. From time to time the molasses was filtered off from the crystals through wire-gauze and analysed.

Sample taken.	Temperature.	Brix.	Pol.	Quotient.
After 1 hour	66	89·46	36·2	40·46
,, 2 hours	65·5	89·96	36·6	40·68
,, 3 ,,	64·5	89·76	35·9	40·0
,, 5 ,,	62·5	88·88	34·8	39·2
,, 6½ ,,	61·5	89·00	34·9	39·3
,, 8½ ,,	60	90·00	34·5	38·3
,, 12 ,,	56·5	89·68	33·2	36·97
Molasses after curing	—	83·16	34·6	41·60

The molasses drained off on curing had the same quotient as the molasses drawn in, showing that it had not parted with any sugar, and thus had only acted as a diluting medium, facilitating circulation.

II.

In this case the analyses of syrup and molasses were fairly the same as in the former experiment, the only change being in the proportion, that of the syrup was slightly higher than in the first case, viz.:—

	Brix.	Pol.	Quotient.
Syrup	45·48	40·0	87·3
Molasses	—	—	41·0
Mixed masse-cuite	94·58	67·2	71·5

Sample taken.	Temperature.	Brix.	Pol.	Quotient.
During strike	64·5	91·43	39·4	43·09
After 1 hour	64·5	91·43	39·4	43·09
,, 3 hours	63	90·91	39·0	42·9
,, 4 ,,	63	91·06	38·8	42·69
,, 5 ,,	62	91·06	38·5	42·28
,, 7 ,,	61·5	90·96	37·9	41·66
,, 8 ,,	61	91·20	37·8	41·44
,, 9 ,,	60	91·20	37·8	41·44
,, 10 ,,	59	91·16	37·6	41·24
,, 11 ,,	58	90·96	37·6	41·34
,, 12 ,,	58	91·30	37·5	41·10
,, 13 ,,	57	91·24	37·5	41·10
,, 14 ,,	56	90·66	37·4	41·25
,, 15 ,,	56	91·30	37·3	40·85

(To be continued.)

AUSTRALIA.

The Sugar Production, 1897-98.

"The Year-Book of Australia," one of the most useful and completely got up of the annuals published in the English language, is now ready, and can be obtained from Messrs. Keegan Paul & Co.* We have already repeatedly expressed our appreciation of this capital book, of which we can speak from experience, having had occasion to make extensive practical use of it in connection with special literary works.

* "The Year-Book of Australia," Demy 8vo., boards, cloth back; over 700 pp., with official Maps of the Australian Colonies.—Keegan Paul, Trench, Trübner & Co., Charing Cross Road, London, S.W. Price, 10s. 6d.

We reproduce below large portions of the article relating to sugar on the Australian Continent.

"Sugar production in Queensland and New South Wales continues hampered by numerous difficulties; those connected with the labour question predominating in the former colony, and those of a fiscal character in the latter. In the semi-tropical portions of Queensland white labour, so far as plantation work is concerned, has generally been found less effective and reliable than coloured labour, but the employment of Kanakas, Chinese, Japanese, and other coloured aliens is regarded, chiefly in the southern portion of the colony, with such disfavour by the white labouring classes, that restrictions of a somewhat burdensome character are rigidly enforced. In New South Wales the duty on imported sugar will not be abolished as originally intended, but remains at £3 per ton, which, it is anticipated, will enable the colonial-grown article to hold its own against the bonus-fed produce of other countries. The existing duties per ton on raw sugar are as follow:—New South Wales £3, Queensland £5, South Australia £3, Tasmania £6, Victoria £5 15s. to £6, Western Australia nil.

"The production of Australian sugar has overtaken local requirements, and in future, unless unfavourable seasons intervene, there will be a small but steadily increasing quantity available for export. With a view to preventing the competition occasioned among colonial sugar growers in possession of surplus stocks, the Colonial Sugar Refining Company is endeavouring to deal with the whole of the sugar not required locally, and has, to some extent, succeeded in so doing."

[The best markets hitherto found are, we believe, Canada and North America. It seems rather absurd that Australia should continue to import sugar from Mauritius and Java, when Queensland and New South Wales are producing more than is required for Australasia, more especially when we consider the fact that in the United States the exported sugar has to meet the competition of the world and so accept lower prices than those obtainable at home. This matter will soon right itself, and indeed the imports are diminishing.—Ed. *I. S. J.*]

New South Wales.

"In the Autralian mother colony the sugar-growing industry is confined principally to the districts watered by the Richmond, Tweed,

and Clarence rivers, the soil and climate of which are admirably adapted for the purpose. Formerly the industry extended in a southerly direction as far as the Macleay river, but the frequent losses occasioned by frost led to its being abandoned. The actual sugar production of the colony has varied considerably at times, as shown in the following table:—

Production of Sugar Cane in New South Wales, 1870-71 to 1897-98.

Year.	Area. Productive.	Area. Non-Productive.	Total.	Production of Cane.
	Acres.	Acres.	Acres.	Tons.
1870-71	1,475	2,607	4,082	....
1871-72	1,995	2,399	4,394	...
1872-73	3,470	2,001	5,471	....
1873-74	3,565	3,105	6,670	...
1874-75	4,087	4,453	8,540	....
1875-76	3,654	2,800	6,454	...
1876-77	3,524	3,231	6,755	99,430
1877-78	3,331	3,735	7,066	99,978
1878-79	2,949	4,489	7,438	104,192
1879-80	3,676	4,102	7,777	126,119
1880-81	4,465	6,506	10,971	121,616
1881-82	4,983	7,184	12,167	128,752
1882-83	6,362	7,176	13,538	169,192
1883-84	7,583	7,401	14,984	204,547
1884-85	6,997	10,520	17,517	105,323
1885-86	9,583	6,835	16,418	239,347
1886-87	5,915	9,202	15,117	167,959
1887-88	8,380	6,907	15,287	273,928
1888-89	4,997	10,284	15,281	110,218
1889-90	7,348	11,382	18,730	168,862
1890-91	8,344	12,102	20,446	277,252
1891-92	8,623	13,639	22,262	185,258
1892-93	11,560	15,191	26,751	264,832
1893-94	11,750	16,357	28,112	252,606
1894-95	14,204	18,705	32,909	264,254
1895-96	14,398	18,259	32,657	207,771
1896-97	18,194	12,859	31,053	320,276
1897-98	12,936	12,929	25,865	269,068

"It will be noted that the production of 1897-98, although below that of 1896-97, was in excess of most previous years. The decreased

acreage is a result of many of the sugar growers devoting a portion of their land to diary-farming, for which both soil and climate are admirably adapted. Nearly the whole of the sugar cane is taken by the Colonial Sugar Company at prices mutually arranged at the commencement of the season; consequently the progress of the industry is largely dependent upon the energy and enterprise of the company, which has a large capital embarked in its operations, having during the last quarter of a century expended considerably over half a million sterling in plant, buildings, &c.; its three mills being equipped with a completeness not excelled elsewhere.

"The tendency of the sugar-manufacturing industry to become concentrated in few hands is shown by the fact that the number of sugar mills has decreased from 64, representing 2,236 horse-power, in 1887-88, to 19, representing 3,627 horse-power, in 1826-97, the production during the latter year being 27,653 tons sugar, and 1,421,406 gallons molasses; against 225,000 tons sugar and 888,000 gallons molasses in 1887-88. In like manner the production of of refined sugar at the Sydney works of the Colonial Sugar Company has risen from 26,895 tons in 1887-88, to 43,220 tons in 1896-97. The number of hands employed in sugar-making and refining is about 1,740.

Queensland.

"Although in Queensland the soil and climate are even more favourable for sugar cultivation than in New South Wales, the difficulties attending the employment of white labour and the prejudices attending that of coloured labour form serious obstacles to the rapid progress of the industry, although it continues highly encouraging; the crop of sugar cane for 1898-99, estimated at about 150,000 tons,* being the largest on record. The history of the industry in Queensland is illustrated by the following table:—

Progress of Sugar Production in Queensland, 1876-77 to 1897-98.

Year.	Number of Sugar Mills.	Acres of Sugar Cane Crushed.	Sugar Manufactured.	Molasses Manufactured.
1876-77	70	7,245	8,214	416,415
1877-78	59	8,043	12,243	490,260
1878-79	68	10,702	13,525	570,301
1879-80	70	11,409	18,714	641,485
1880-81	83	12,306	15,564	602,960

* The official estimate of this crop, just to hand (May, 1899), is 164,000 tons.—[Ed. *I. S. J.*]

Year.	Number of Sugar Mills.	Acres of Sugar Cane Crushed.	Sugar Manufactured.	Molasses Manufactured.
1881-82	103	15,550	19,051	753,658
1882-83	120	16,874	15,702	663,828
1883-84	152	25,792	36,148	1,071,413
1884-85	166	29,951	32,010	804,613
1885-86	166	40,756	59,225	1,784,626
1886-87	160	36,104	56,859	1,510,308
1887-88	118	34,821	57,960	1,421,430
1888-89	106	30,821	34,022	722,162
1889-90	125	31,239	44,411	942,837
1890-91	110	39,435	69,983	1,640,662
1891-92	68*	36,821	51,209	No return.
1892-93	72*	40,572	61,386	1,343,281
1893-94	61*	43,670	76,146	269,162
1894-95	62*	49,839	91,712	956,276
1895-96	64*	55,771	86,255	1,730,591
1896-97	81*	83,093	100,774	2,195,470
1897-98	62*	65,432	97,916	2,364,020

"The Queensland agricultural returns show that sugar cane forms the second staple agricultural crop of the colony, the first place being occupied by maize, to the cultivation of which 109,721 acres are devoted, the two crops representing more than half the agricultural production of the colony, the area under sugar cane being 102,152 acres.

"A great impetus was given to the sugar industry by the passing of Acts empowering the Queensland Government, on the application of an incorporated company, to guarantee its debentures with interest at 3½ per cent., the proceeds to be devoted to the erection of works for the extraction of sugar, taking, as a protection against loss, a mortgage over the works and over freehold land in the vicinity. This action has assisted in opening to the sugar industry important areas of land which otherwise would have remained unutilised for sugar cultivation. Up to the present time a sum of £360,000 has been advanced to twelve different companies, the State mortgages covering, in addition to the works, 108,895 acres of freehold land available for sugar cultivation. The demand for sugar in some form or other for brewing and jam-making is on the increase, the latter industry requiring about 160,000 cwts. annually.

* Mills crushing cane only not included.

Import and Export Trade.

The steady development of Australian sugar production has to some extent effected the over-sea import trade, but not to the extent anticipated, a considerable quantity being required for re-export. *Much of the trade is of an inter-colonial character.* The imports during 1897-98 were as follow:—

Australian Raw and Refined Sugar Imports.

	Tons.	£
New South Wales..	40,018	546,776
Queensland	46	952
South Australia	34,102	440,243
Tasmania	6,953	95,493
Victoria	64,604	762,184
Western Australia	7,221	105,366
Total..	152,944	1,951,014

"The New South Wales imports were chiefly from Queensland and Mauritius, and those of Tasmania and Victoria largely from the latter country and Java. The exports ar subjoined:—

Australian Exports of Raw and Refined Sugar, 1897-98.

	Tons.	£
New South Wales..	5,339	80,261
Queensland	62,418	681,238
South Australia	5,997	96,228
Tasmania	1	19
Victoria	8,007	152,415
Western Australia	3	30
Total	81,766	1,010,191

"Considerable quantities of molasses are annually produced in New South Wales, as shown in previous tables, and used principally in the manufacture of spirit, the import and export trade being mostly intercolonial. In 1897-98 the imports were as follow:—

Australian Imports of Molasses and Glucose.

	Tons.	£
New South Wales	12,434	15,680
Queensland	89	928
South Australia	218	1,666
Tasmania	266	3,874
Victoria	4,125	14,611
Western Australia	207	3,374
Total	17,339	40,133

The exports were as follow:—

Australian Exports of Molasses and Glucose, 1897-98.

	Tons.	£
New South Wales	2,560	10,248
Queensland	1,209	10,763
South Australia	310	4,369
	4,079	25,380

Beet Sugar.

"The cultivation of sugar beet has progressed slowly, the results being at present too uncertain to offer much inducement to agriculturists. In Victoria a sugar beet factory has been established at Maffra, the Victorian Government granting assistance to the amount of £63,000 under certain conditions, with encouraging results, the sugar reaching a standard of purity of 99·9, the average being 99·8. Sugar of this quality finds a ready market at from £20 to £21 10s. per ton. The operations of the factory are, however, seriously impeded by excessive cost of cartage occasioned by bad roads, dearness of labour, and want of skilled employés. Moreover, the proper saccharine quality of beet depends largely on the character of the season. Then, again, the beet grown in new land contains a less proportion of sugar-producing material than that obtained from land previously under beet cultivation, a fact which explains the disappointment experienced by farmers with their first crops of beet. Should the Maffra establishment succeed in overcoming the obstacles which have hitherto impeded its progress, its success will materially influence the future of the sugar beet industry in Australia.

"In a report by the Queensland Registrar-General, it is stated that producers of cane sugar appear confident that they could easily maintain their position against beet sugar, if, indeed, they could not exclude it altogether from the market, but for the special conditions under which it is manufactured and marketed. Great improvements have been effected in the production of both kinds of sugar, but on which side it has been greatest has yet to be ascertained. The cultivation of beet for sugar was to have been systematically carried on at Tenterfield, in New South Wales, but, so far, little or nothing has been done in the matter."

A NEW MODIFICATION OF CLERGET'S METHOD, SPECIALLY APPLICABLE TO AFTER-PRODUCTS AND MOLASSES.

By ARTHUR R. LING and JULIAN L. BAKER.

(Journal of the Society of Chemical Industry.)

Wilhelmy and, later, Ostwald have shown that the hydrolysis of saccharose in aqueous solution proceeds according to the well-known law of mass action of Guldberg and Waage, so that, for example with acids, the amount of hydrolysis in a given time is proportional to the product of the reacting masses.

The speed of the inversion of saccharose by acids, other conditions being constant, varies with the nature of the acid employed. Acids such as hydrochloric, sulphuric, &c., which according to theory exist in aqueous solution for the most part dissociated into their ions, hydrolyse much more saccharose in unit time than do weak organic acids; and, as a matter of fact, this same reaction has been employed by Ostwald as a means of determining the strength (affinity) of acids.

Now it is well known that the dark after-products which are generally dealt with in the sugar industry, contain, besides sugar, other organic, matters consisting to some extent—in all probability for the most part—of the salts of organic acids. At all events, a sufficiency of these salts is present to react with the hydrochloric acid added in carrying out Clerget's process, and to partially replace it by much weaker organic acids. The matter is not improved when the solution under investigation is previously clarified, as it usually is, with basic lead acetate, for here the hydrochloric acid is to some extent neutralised by the alkalinity of the basic lead acetate, besides which it is partially replaced by the comparatively weak acetic acid, and there is some danger that the inversion of the saccharose may not have reached completion in the prescribed time. To obviate the presence of an organic acid, it has been proposed by Herles (Zeit. Zuckerind. Böhmen, 1889, 557) to use a solution of lead nitrate in conjunction with one of sodium hydroxide as the clarifying agent. The experiments of Herzfeld and others have shown, however, that the rotatory power of saccharose is diminished by the employment of this clarifying agent.

There is, however, another objection to the use of Clerget's method, as it is at present carried out, for the estimation of saccharose in

products containing much "other organic matter." For, although the presence of a great many definite substances has been demonstrated in the juice of both sugar cane and beetroot (see this Journal, 1893, 533), the nature of this organic matter in a given sample of sugar or molasses cannot be determined. It is, however, well known that these substances are to some extent optically active. and experience shows that even after clarification with basic lead acetate some optically active substances besides sugar remain in solution.

As one of us has stated in the preceding paper, Clerget's method presupposes that no other constituents of the sample than the saccharose suffer any change in optical activity by the treatment adopted. But since the agent employed—acid—is a general hydrolyst, we can be by no means certain that this is the case. This objection will not count, of course, with those who are accustomed to speak of the "Clerget value," and who regard the method merely as an empirical one, capable of yielding good comparative results for purposes of buying and selling. But the sugar refiner, the distiller, and other technologists require something more than comparative accuracy if they are to use the results of chemical analysis to control their manufacturing operations. To them the method can have no value except as one which furnishes the percentage of saccharose in a given sample.

Now it is obvious that if, instead of employing a general hydrolyst such as an acid, we made use of one which would act selectively on saccharose only, the absolute accuracy of the method would be considerably enhanced, as would also its value *pari passu* to the chemical manufacturer. Such a hydrolyst is the invertase of yeast, which hydrolyses, or to use the more familar term, inverts saccharose and other substances having a similar configuration.

As you all know, saccharose may be regarded as an ether composed of residues of dextrose (*d*-glucose) and levulose (*d*-fructose), these residues being arranged in space in certain relative positions with respect to each other. The researches of Emil Fischer have shown that enzymes such as invertase probably act on substances of similar configuration, that is to say, substances in which the spacial arrangements of the various atomic groups within the molecule is the same. Fischer has produced by synthesis two methyl derivatives of glucose, one of which—the α-compound—contains a methoxyl group, arranged probably in the same relative position to the glucose residue as the levulose residue is arranged to the glucose residue in the molecule

of saccharose. Both saccharose and α-methyl glucose are hydrolysed by invertase.

Now the only substance, the configuration of which is in any way similar to that of saccharose, which is known to occur in commercial sugar products is raffinose, a sugar which may be regarded as an ether of glucose, levulose, and galactose. In this substance the levulose residue is apparently combined with the remainder of the molecule in the same manner as it is in saccharose, since ordinary invertase hydrolyses it. Raffinose, as far as we know at present, only occurs in those products obtained from beetroot, and if it be true that it is hydrolysed by invertase, this in no way invalidates the method we are about to propose, since, when its presence is demonstrated, it will only be necessary to employ another formula, and the percentage of saccharose and raffinose may be calculated from the optical rotary powers obtained before and after inversion, just as is done at present with the acid process. We make these remarks, however, with reservation, for Loiseau, and more recently Bau, have shown that the enzymes of high and low yeasts exhibit a different behaviour towards raffinose. It is, however, important to point out that both these chemists agree that the invertase of high yeasts hydrolyses raffinose to levulose and melibiose just as does the acid employed in Clerget's process; this requires the fixation of one molecule of water. The enzymes of low yeasts, on the other hand, are said by the same authorities to hydrolyse raffinose to galactose, glucose, and levulose (see this Journal, 1895, 54 and 80) which requires the fixation of two molecules of water. We will say no more on this point at present, as we intend to repeat the experiments of Loiseau, Bau, and others, in order to ascertain whether the method of inversion with high yeast can be made use of for the simultaneous estimation of saccharose and raffinose.

Our proposal is therefore to use invertase, or rather English high-fermentation yeast, as hydrolysing agent in carrying out Clerget's method. We are aware that our idea has been to some extent anticipated by other workers. Thus Kjeldahl (Res. du Comptes Rend. des trav. du Labre. Carlsberg, 1891, I., 192) showed that the saccharose in malt may be estimated by acting on the cold-water extract with yeast in presence of thymol, which latter arrests alcoholic fermentation; whilst some years afterwards C. O'Sullivan (J. Chem. Soc. Trans. 1886, 58) described a method for the same purpose, using invertase. In the year 1891, it was shown by O'Sullivan and Tompson

(J. Chem. Soc. Trans. 1891, 46) that the addition of thymol was unnecessary in acting on sugar with yeast, as no alcoholic fermentation occurs at a temperature of 55° C. Both Kjeldahl and O'Sullivan used this method for determining small amounts of saccharose, the highest percentage of that sugar which the process was used to estimate being about 10 per cent. in a sample "treacle." (O'Sullivan and Tompson, *loc. cit.*) Such commercial products as beetroot molasses, however, frequently contain as much as 50 per cent. of saccharose together with a large amount of other organic matter, and we were anxious to ascertain if the method of inversion with yeast could be used to estimate the saccharose in these.

(To be continued.)

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; 322, High Holborn, London; and 118, New Street, Birmingham.

ENGLISH.

APPLICATIONS.

7457. J. Critchlow, Stoke-on-Trent. *Improvements in and applicable to filter-presses.* 10th April, 1899.

7699. A. E. Krause, London. *Improvements in filters.* (Complete specification.) 12th April, 1899.

8083. E. E. Marchand, London. *Improvements in or relating to centrifugal pumps.* 17th April, 1899.

8154. W. Chambers, London. *Improvements in and relating to turbines and other like motors.* 18th April, 1899.

8222. M. B. Zahn, London. *Improvements in or relating to the treatment of sugar molasses or syrup by means of lime.* (Complete specification.) 19th April, 1899.

8414. E. Makin, junr., Manchester. *Improvements in apparatus for heating, evaporating, and condensing.* 22nd April, 1899.

8445. J. Scott, Duddington, Edinburgh. *Sugar cane and beetroot juice extractor.* 22nd April, 1899.

8553. J. W. Graydon, London. *Improvements in engines of the turbine class, actuated by steam or other fluid under pressure.* 24th April, 1899.

8814. J. Mc.Neil and C. Mc.Neil, Glasgow. *Improvements in evaporating or concentrating apparatus.* 27th April, 1899.

8856. E. W. Köster, London. *Improved valve mechanism for compression and vacuum pumps.* (Complete specification.) 27th April, 1899.

9039. H. A. Thirion, London. *Improvements in centrifugal pumps.* 29th April, 1899.

9129. E. Casper, London. *Improvements in the treatment of raw sugar.* 1st May, 1899.

9131. E. Casper, London. *Improvements in centrifugal apparatus for treating raw sugar.* 1st May, 1899.

9132. E. Casper, London. *Improvements in apparatus for treating raw sugar.* 1st May, 1899.

9133. E. Casper, London. *Improvements in drums for drying sugar.* 1st May, 1899.

9276. M. Jolles and A. Jolles, London. *Improvements in and relating to the manufacture of filters and filtering materials.* 2nd May, 1899.

9312. H. C. Bull and A. Watling. *Improvements in or connected with the manufacture of sugar.* 3rd May, 1899.

9463. W. Warner, Northampton. *Improvements in filter presses.* 5th May, 1899.

ABRIDGMENTS.

8592. C. J. Crosfield and S. Stein, Liverpool. *Improvements in or connected with the manufacture and refining of beet, cane, and other sugars.*" 13th April, 1898. This improvement, which is connected with the refinement of beet, cane, and other sugars, consists in treating dissolved raw sugar to be refined with phosphoric acid to render it acid, then with an aluminous compound and with tannic acid or a phosphoric compound, and then the resulting filtrate with per-oxide of hydrogen and a phosphoric compound.

8593. C. J. Crosfield and S. Stein, Liverpool. *Improvements in or connected with the manufacture of cube sugar.* 13th April, 1898. This invention has reference to the manufacture or production of cube sugar, and has for its object to provide an improved method or process of manufacturing sugar cubes or slabs to be subsequently cut up into cubes, direct from raw sugar crystals or sugar which has been refined, and in the form of crystals without going through operations or treatments which are non-continuous or non-direct as happens at present; and it consists in the mixing together of sugar

crystals and sugar solution by mixing machinery; then delivering the same from the mixing machinery on to a pressing mechanism, and then moving the charges under pressing devices, where they are pressed, and subsequently discharging the cakes so pressed from the machine.

GERMAN.

ABRIDGMENTS.

101696. DAVID KEMPE, Stockholm, and K. D. NATHORST, Malmö. *Improvements in the process of precipitation with saccharate of lime, by introducing both molasses and lime in a finely divided condition.* 7th March, 1897. According to Patent No. 90159 the quantity of lime required to precipitate the saccharate of lime is sensibly diminished by distributing the lime in a very finely divided condition (spray form) over the surface of the molasses in order by means of stirrers to become amalgamated with the same. By this arrangement, however, the finely divided lime collects in lumps, thus preventing the even distribution of the lime in the liquid. By the new process not only is the lime introduced by means of a blast, but the molasses, by means of an injector in the re-action vessel, is also introduced in a finely divided condition, thus effecting a great saving in lime.

102009. G. Y. BAER, Vierverlaten, near Groningen, Holland. *Automatic engaging and disengaging apparatus applicable for triturating machines, especially for beetroot shredding machines.* 19th April, 1898. The engagement of the shredding machine is effected by the action of the weight of material which is placed in the hopper of the machine to be operated on, for when the weight has reached a certain amount it actuates the disengaging gear in such manner that the endless belt is shifted from the empty cylinder on to the fixed cylinder, and, on the contrary, when the hopper is emptied the belt is shifted from the fixed cylinder on to the empty cylinder, and thus the machine is brought to a standstill.

Patentees of Inventions connected with the production, manufacture, and refining of sugar will find *The International Sugar Journal* the best medium for their advertisements.

The International Sugar Journal has a wide circulation among planters and manufacturers in all sugar-producing countries, as well as among refiners, merchants, commission agents, and brokers, interested in the trade, at home and abroad.

IMPORTS AND EXPORTS OF SUGAR (UNITED KINGDOM).

To end of April, 1898 and 1899.

IMPORTS.

Raw Sugars.	Quantities.		Values.	
	1898.	1899.	1898.	1899.
	Cwts.	Cwts.	£	£
Germany	2,083,012	1,350,386	916,165	629,942
Holland	91,365	194,641	36,434	87,189
Belgium	231,831	646,233	97,962	303,295
France	691,092	452,318	335,472	232,695
Java	45,000	71,120	23,707	41,065
Philippine Islands	165,790	70,349	62,298	32,377
Cuba and Porto Rico	4,500	1,320	2,500	1,000
Peru	433,001	213,571	219,061	115,967
Brazil	169,698	28,275	75,908	14,422
Mauritius	....	48,065	....	23,143
British East Indies	43,210	52,363	16,575	23,824
British W. Indies, British Guiana, & Brit. Honduras	346,675	334,099	201,736	251,261
Other Countries	261,756	336,562	127,961	188,770
Total Raw Sugars	4,566,930	3,799,302	2,115,779	1,944,950
Refined Sugars.				
Germany	3,120,820	3,756,770	1,928,322	2,300,793
Holland	729,906	767,501	463,140	504,620
Belgium	126,073	85,725	81,385	54,764
France	693,572	740,721	427,884	458,560
United States	4,148	1,165	4,970	1,591
Other Countries	26,812	9,236	15,031	5,316
Total Refined Sugars	4,701,331	5,361,118	2,920,732	3,325,644
Molasses	336,166	453,012	84,975	112,494
Total Imports	9,604,427	9,613,432	5,121,486	5,383,088

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden and Norway	28,946	26,585	16,949	16,671
Denmark	43,565	40,453	21,167	21,922
Holland	35,632	34,870	19,462	20,510
Belgium	5,186	5,113	2,795	3,003
Portugal, Azores, &c.	34,914	29,930	18,695	16,645
Italy	14,777	6,946	7,705	3,943
Other Countries	71,467	78,928	41,007	45,467
	234,487	222,825	127,780	128,161
Foreign & Colonial Sugars.				
Refined and Candy	52,120	50,313	31,930	32,059
Unrefined	215,627	115,013	117,544	66,750
Molasses	86,217	39,316	26,386	11,839
Total Exports	588,451	427,467	303,640	238,809

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1899. Tons.		1898. Tons.
Total Receipts, 1st Jan. to 18th May ..	701,999	..	552,242
Receipts of Refined ,, ,, ,, ..	1,602	..	11,810
Deliveries ,, ,, ,, ..	723,520	..	548,597
Consumption (4 Ports, Exports deducted) since 1st January	581,832	..	452,111
Importers' Stocks (4 Ports) May 17th ..	5,899	..	73,361
Total Stocks, May 24th	245,000	..	340,573
Stocks in Cuban Ports, May 24th ..	78,000	..	85,221
	1898.		1897.
Total Consumption for twelve months ..	2,047,344	..	2,071,413

CUBA.

Statement of Exports and Stocks of Sugar, 1898 and 1899.

(Tons of 2,240lbs.)	1898. Tons.		1899. Tons.
Exports	173,372	..	119,971
Stocks	84,049	..	101,868
	257,421		221,839
Local Consumption (four months)	15,600	..	14,500
	273,021		236,339
Stocks on the 1st January (old crop)	1,515	..	4,336
Receipts at Ports up to 30th April.. ..	271,506	..	232,003

Joaquin Guma.

UNITED KINGDOM.

Statement of Four Months' Imports, Exports, and Consumption for Three Years.

	1899. Tons.		1898. Tons.		1897. Tons.
Stock, 1st January	76,930	..	90,030	..	139,623
Imports, Raw Sugar, Jan. 1st to April 30th	189,965	..	228,346	..	179,768
,, Refined, Jan. 1st to April 30th..	268,056	..	235,067	..	225,091
,, Molasses, Jan. 1st to April 30th..	22,651	..	16,808	..	18,384
	557,602		570,251		562,866
Stock, in 4 chief Ports, April 29th	49,536	..	73,352	..	88,379
	508,066		496,899		474,487
Exports (Foreign, and British Refined) ..	21,373	..	29,422	..	31,651
Apparent Consumption for Four months..	486,693		467,477		442,836

STOCKS OF SUGAR IN EUROPE AT UNEVEN DATES, MAY 1ST TO 20TH, COMPARED WITH PREVIOUS YEARS.

IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	TOTAL 1899.
51	601	451	360	111	1574

	1898.	1897.	1896.	1895.
Totals	1816 ..	1796 ..	1775 ..	1750

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 30TH APRIL, IN THOUSANDS OF TONS.

Great Britain.	Germany	France.	Austria.	Holland, Belgium, &c.	Total 1898-99.	Total 1897-98.	Total 1896-97.
1668	784	583	372	443	3850	3667	3405

ESTIMATED CROP OF BEETROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE CURRENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1898-99.	1897-98.	1896-97.	1895-96.
	Tons.	Tons.	Tons.	Tons.
Germany	1,725,000 ..	1,852,857 ..	1,836,536 ..	1,615,111
Austria	1,040,000 ..	831,667 ..	934,007 ..	791,405
France	835,000 ..	821,235 ..	752,081 ..	667,853
Russia	775,000 ..	738,715 ..	714,936 ..	712,096
Belgium........	220,000 ..	265,397 ..	288,009 ..	235,795
Holland	155,000 ..	125,658 ..	174,206 ..	106,829
Other Countries..	160,000 ..	196,245 ..	202,990 ..	156,340
	4,910,000	4,831,774	4,902,765	4,285,429

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

The tendency of our market during the whole of May has been an advancing one, and this is fully warranted by the statistical position, which has been further improved, since we last wrote, by the estimated sowings of beet on the continent. These do not, excepting in Russia, appear likely to exceed those of last year to any appreciable extent, and the cultural yield in Russia is much inferior to that of other beet growing countries. At one time the quotation for prompt beet reached 11s. 6d., and for August delivery, 11s. 8½d., but a quieter tone has since set in, and the month appears likely to close without any great alteration of the prices ruling when we last wrote. Uncertainty as to the exact course that sugar matters may take in the United States appears to be the most tangible reason for the present quietness; the change in the position of America towards Cuba, Porto Rico, and the Hawaiian Islands renders any reliable comparison with last year very difficult as regards the quantity of European sugar likely to be taken by the United States refiners, and there is also the possibility of a larger beet crop in that country. Still, with the small stocks with which it appears almost certain the season will close, we shall be surprised if speculators do not take advantage of the position. There is but little doing in cane sugars.

The following quotations are in all cases for prompt delivery :—

			Last Month.
Porto Rico, fair to good Refining	11/6 to 12/9	against	11/6 to 12/6
Cuba Centrifugals, 97°/° polarization....	12/9	,,	12/6
Java, No. 14 to 15 D.S.	13/0 to 13/3	,,	12/9
British West India, fair brown	11/6 to 12/0	,,	11/9
Bahia, low to middling brown	10/3 to 11/0	,,	10/3 to 10/0
,, Nos. 8 and 9..	11/0 to 11/6	,,	11/0 to 11/3
Pernams, regular to superior Americanos.	11/3 to 11/9	,,	11/3 to 11/9
Madras Cane Jaggery..	9/9 to 10/0	,,	9/9
Manila Taals	9/3 to 9/6	,,	9/6

French Crystals, No. 3, f.o.b.	12/3	,,	12/0
Russian Crystals, c.i.f..	?	,,	?
German granulated, f.o.b.	12/6¾	,,	12/3
Tate's Cubes..	16/3	,,	16/0
Beet, German and Austrian, 88%, f.o.b...	11/3	,,	11/0

THE INTERNATIONAL SUGAR JOURNAL.

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☞ All communications to be addressed to Edward Sutton, 24, Seymour Road, Manchester.

Advertisements from those desiring employment are inserted Free of Charge. All Advertisements to be sent *direct*.

☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

Erratum.—In our last month's number, page 313, line 19, for "density of the roots," read "density of the juice."

We have received from Dr. H. W. Wiley, Chief of the Division of Chemistry in the United States Department of Agriculture, Washington, an obliging letter, referring to the remarks in our May issue on the question of the influence of temperature on polarisation. This letter will be found at the end of the present number, and effectually settles (for the present at any rate) any question as to the priority of claim to recognition of the variation of polarisation as a result of change in temperature.

The present number contains the completion of our extracts from Mr. Martineau's paper on "The Statistical Aspect of the Sugar Question," read before the Royal Statistical Society on the 18th April last, and we would remind our readers that the full text of the paper can only be found in the quarterly number of the *Journal of the Royal Royal Statistical Society*, appearing on the last day of June, to be obtained either through a bookseller, or by writing to the Office of the Society, 9, Adelphi Terrace, Strand, London, W.C. The journal will also contain a report of the discussion that took place, and a précis of Mr. Martineau's reply to his critics. The full text is indispensable to those who want to follow up properly every detail of this most useful and timely contribution to the literature of the "Sugar question."

Messrs. Blyth Bros. & Co., Mauritius, give shipments of sugar from 1st August, 1898, to 27th May, 1899, as 171,246 tons, against 105,175 tons during the corresponding period of the preceding season. The quantities shipped to respective countries were, in tons:—Europe, 7,693; U.S.A., 41,274; Australia, 6.075; Cape, 25,074; India, 88,716; Hong Kong, 1,229; sundry, 1,165. The falling off in shipments to Australia is noteworthy; last year they were 10,836, and the preceding year 25.557 tons.

Exports from British Guiana from 1st January to 5th June:— Sugar, 23,650 tons; rum, 4,427 puns.; molasses, 2,216 casks; cocoa, 82,229 lbs.; against 37,505 tons, 8,614 puns., 1,008 casks, and 27,234 lbs. respectively for the like period last year.

The Trinidad crop may now be considered as completed, and the total will amount to about 60,000 tons which has nearly all been exported. The molasses principally go to Martinique, where they are converted into tafia.

In the House of Commons, on the 15th June, Sir H. Fowler moved for an address to the Crown, praying the Queen to disallow the Indian Tariff Act imposing countervailing duties on bounty-fed sugar imported into India. The motion was rejected by 293 against 152, nearly two to one, a majority (says *The Times*) larger than the Government can command on a strict party vote. As regards India, the question is now set at rest, but the very satisfactory result certainly permits us to entertain more confident hopes of the eventual adoption of similar countervailing duties in this country.

Much has been made, in and out of the House, of a resolution adopted at a meeting of the Directors of the Manchester Chamber of Commerce (in direct opposition to the declarations of the London and Glasgow Chamber of Commerce) but it is possible that a meeting of the whole Chamber might have expressed a different opinion, and the following letter, which appeared in the *Manchester Courier* of the 17th June, is well worth considering by those who gave such prominence to the resolution in question, and it may be remarked that a similar letter addressed to the *Manchester Guardian* was declined by that paper, undoubtedly as not being in accordance with the ideas of the party which it represents, and which sustained so signal a defeat on the occasion above recorded.

INDIAN SUGAR BOUNTIES.

To the Editor of the "Manchester Courier."

Sir,—As the resolution of the Manchester Chamber of Commerce was so freely quoted during last night's debate, allow me to state that there were only eight of us present when this resolution was passed, and that the decision was not unanimous. I hold that in cases of such far-reaching consequences the opinion of the whole Chamber should be tested, and that the "aye" of six or eight gentlemen should not go forth unchallenged as the deliberate opinion of Manchester. What is called Free-trade in the resolution is not genuine Free-trade, and what is called Protection is really the first step towards sound Free-trade. The good of the many was pleaded in favour of the resolution, but it is not sound Free-trade if the benefit of the many is to be bought by robbing the few, or by injuring them in their legitimate interests. The good of the many is a just plea if you deal with and wish to abolish the unjust privileges of a class; that is, in all cases where by some means or other an unfair advantage exists to the benefit of the few, and at the expense of the many. It is not a fair or honest cry if you wish or attempt to hurt the legitimate rights and interests of a section of the people in order to confer an undeserved benefit upon another section, and give an unfair advantage to the many. It is right and just to abolish the class privileges of the few in order to give equal rights to the many; but it is wrong to rob A in order to enrich B, or to distribute A's property amongst his neighbours. It is easy to be generous at other people's expense; but charity begins at home. I think we shall get a fair grasp of the situation if we imagine some few of us to be, say, Indian farmers, another few to be Indian refiners, and the rest of us to be general consumers. The farmer and refiner are able and content to compete on Free-trade principles in the growing and making of sugar. They ask for a fair field and no favour for themselves; but they strongly object to being handicapped against their foreign competitors in order to give an unfair benefit to the consumers. How should we feel in this matter if to-morrow any of us were to be in a similar position to that of the Indian farmer, if, say, bounty-fed chemical or other products were to be imported against the products of this country, or if in some of the neutral markets we had to meet the competition of bounty-fed cotton, silk, or metal articles. Should we then still call it "Free-trade," and should we then also be eager to protest against any interference with such export bounties on the ground that we were enjoying the benefit of genuine "Free-trade?" Let us be equally just in this case, and let us claim, in the name of all producers, a fair field and no favour as the true principle of sound "Free-trade."

Yours, &c.,
H. E. Wollmer.

Manchester, 16th June, 1899.

CENTRAL FACTORIES AND THE WEST INDIES.

For some time paragraphs, more or less accurate, have been appearing in the West Indian journals relative to negotiations and investigations which were reported to be in progress relative to the establishment of Central Factories in one or other of the islands. We have thought it advisable not to make any mention or to comment upon these (occasionally conflicting) statements, as no good purpose could be served by prematurely noticing matters which were as yet only in the inchoative stage. The position of many of these Colonies and the causes which had led to that position were only too well known, and we had already unhesitatingly and repeatedly expressed our opinion that the only remedy was Central Factories, which, of

course, also meant the finding of the necessary capital. We are happy in knowing that arrangements are being made which will probably in more than one instance secure this desirable end, and the following extracts from an article in the *Glasgow Herald* may be considered as more accurate than anything bearing on this subject which has yet appeared in print. The fact that enquiries were being made, under Mr. Chamberlain's direction, in more than one of the West India Islands, by practical Glasgow engineers, has already long been known, and we shall not have to wait long for further developments in a similar direction. We have already been informed by Sir Cuthbert Quilter, in a published report addressed to Mr. Chamberlain, that the next word will have to be spoken by the Government, and until their decision is given, it is really premature to mention names or attempt to go into details.

"Mr. Robert Harvey, Engineer and Managing Director of the well-known firm of M'Onie, Harvey & Co., Limited, of this city, acting under instructions from the Colonial Office, is at present in the Island of Antigua, the object of his visit being to report upon the practicability of establishing a system of central factory, or factories, in that island, to convert the sugar cane into sugar, and to arrange details, so that if practicable, the work may be proceeded with at once. Mr. Chamberlain has been fortunate in securing Mr. Harvey's services in this matter. He has had long and varied experience in the sugar industry in all parts of the world where the sugar cane grows, and in the erection of factories and refineries. He has taken with him as his expert adviser in questions relative to cultivation and manufacture, Mr. John J. Wilkie, who has had a very considerable experience in the cane sugar industry in the West Indies and other parts of the world. From the experience of two such experts a report may be looked for which will place the whole question of central factories for the West Indian islands in a thoroughly practical and simple form, from which the Government may at once decide what are the best steps to be taken to make these central factories a success. These gentlemen, in the meantime, are to confine their attention to the island of Antigua, where, for the last five years, a great desire has been expressed by the planters to have central factories erected. The experience of central factories elsewhere has opened the eyes of the planters to the fact that the loss to the island, from want of a proper up-to-date factory, represents a sum of something like £50,000 to £60,000 per annum, which could be avoided. Of course, perfect machinery costs a great deal of money, and it is only by establishing a central factory system that small cane growers can obtain the advantage of the most perfect machinery, high extraction, and consequently a correspondingly higher price for their cane."

Mr. Harvey, who has just returned to Glasgow, has requested us to state that a paragraph which has been going the rounds relating to his visit to Antigua, connecting it with a proposal of Mr. Duncan Stewart and with a visit of Mr. Leymore Marshall, is misleading, inasmuch as he (Mr. Harvey) was neither accompanied by nor had any connection with any other gentleman than Mr. Wilkie, but went on behalf of the Government to examine the Island entirely from his own point of view, and will report entirely independently.

PATENT WATER-DRIVEN CENTRIFUGALS.

We have not hitherto noticed this very convenient and economical application of water instead of steam power to the driving of centrifugals, but the system has now been before the public for some little time, and we understand has met with great approval, and has been largely adopted; the countries to which the adaptation has been delivered by the patentees being, in addition to Great Britain (where it is also in use in works other than sugar refineries), the Argentine Republic, Brazil, Chile, Holland, the Hawaiian Islands, Java, Mexico, Natal, Queensland, Russia, and Sweden, in all of which it is applied in the sugar industry.

The following are the advantages claimed by the patentees:—

While retaining all the benefits of the self-balancing principle of the "Weston," with its central bottom discharge, there is with this Machine an entire absence of belting and gearing.

There are no working parts requiring oil, except the spindle which carries the revolving basket.

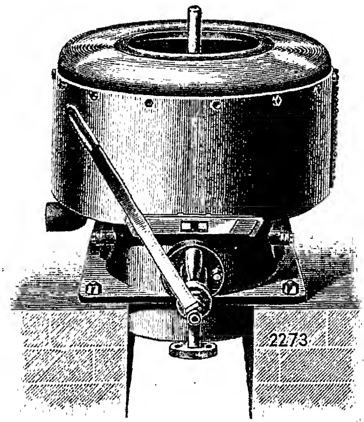
The Machines may be placed in any desired position without regard to the location of driving engine or other source of power. The space occupied is defined by the actual size of the Centrifugal itself.

The pump which supplies the water at the required pressure may be placed in any convenient part of the building, or beside the steam boilers, if preferred. The water is returned from the Machines to the pump to be used over again. A small tank is placed near the pump from which it draws for this purpose.

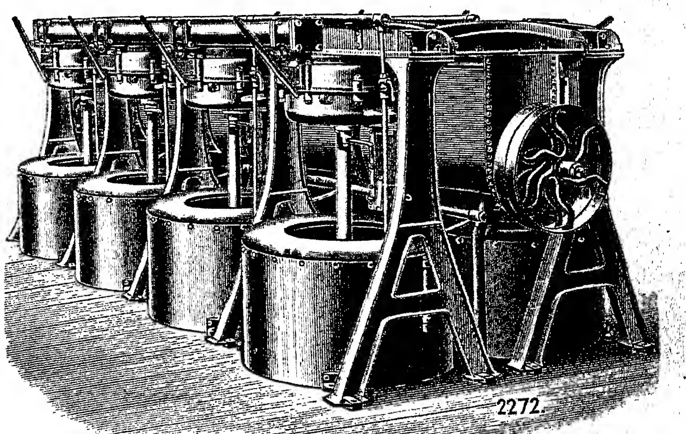
The pumps usually supplied are of the duplex type, which require no special attention, as they stop or start of themselves as the Centrifugals are stopped or started. Belt-driven pumps, which automatically deliver a supply of water as required, can also be supplied.

We are able to furnish illustrations of two out of several arrangements which have been delivered by the manufacturers, suitable for large or small requirements.

The figure below represents one 30-inch (762 m.m.) Patent Pivot Water-driven Centrifugal (Weston type).



The second illustration shows a set of eight 42-inch (1067 m.m.) Machines, with framing and feeding trough.



The Sole Manufacturers are Messrs. Watson, Laidlaw & Co., Glasgow, whose long experience with this class of Centrifugals ("Weston") offers every guarantee for quality and efficiency, and to whom application should be made for illustrated catalogue and all information.

THE STATISTICAL ASPECT OF THE SUGAR QUESTION.

Completed from page 317.

We continue our extracts from Mr. Martineau's valuable paper, read in April before the Royal Statistical Society, and come now to the second division, dealing with exports of sugar from France, Germany, and Austria. The lecturer commenced with France because, although her exports are now inferior to those of the other two countries, it was the French exports which first created the "Sugar Question." The subject is introduced by the following table of exports of French refined sugar:—

	Tons.		Tons.		Tons.
1860-61 ..	66,627	1873-74 ..	194,288	1886-87 ..	117,225
1861-62 ..	68,223	1874-75 ..	232,025	1887-88 ..	153,923
1862-63 ..	103,867	1875-76 ..	269,337	1888-89 ..	115,907
1863-64 ..	134,302	1876-77 ..	234,228	1889-90 ..	139,844
1864-65 ..	118,133	1877-78 ..	198,295	1890-91 ..	152,840
1865-66 ..	149,639	1878-79 ..	174,902	1891-92 ..	121,053
1866-67 ..	120,084	1879-80 ..	151,916	1892-93 ..	126,576
1867-68 ..	116,400	1880-81 ..	130,448	1893-94 ..	113,783
1868-69 ..	102,596	1881-82 ..	117,149	1894-95 ..	130,881
1869-70 ..	121,043	1882-83 ..	118,997	1895-96 ..	119,901
1870-71 ..	125,478	1883-84 ..	122,683	1896-97 ..	110,764
1871-72 ..	98,345	1884-85 ..	113,674	1897-98 ..	146,716
1872-73 ..	178,977	1885-86 ..	71,166		

Mr. Martineau remarks in connection with this, that owing to the manner in which the yield of refined was calculated, *i.e.*, below the yield really obtained, a bounty was obtained on export even so far back as 1860, and this became larger owing to the increasing cleverness of the refiners, and the International Convention of 1864 failed to remedy the evil, from the inherent vice of the system, the bad faith of the French Government, and yet more from the clever way in which the French refiners manipulated the defective system, by using the highest sugar in each class, and falsifying the appearance of the raw sugar so as to lower its classification. By these means the bounties to the Paris refiners were rapidly increased, and when the sugar duty was nearly doubled, after the war of 1870, their bounties

were consequently by a stroke of the pen also doubled. The figures of the table show the result, a great increase in exportation from 1872 to 1879. During those years the British refiners made persistent efforts to obtain some international remedy, and though they failed, in spite of several international conferences, to obtain a convention for the abolition of bounties, their efforts were not without result. The full investigation of the question, at the conferences of 1875, 1876, and 1877, resulted at all events in the French Government taking some precautions, on their own account, to check the increase in the bounties, by means of what they called saccharimetric control of the refineries. This began in 1877, and was more fully carried out in 1880. The effect on the exports is manifest. Ten years later, after the abortive conferences of 1888, the French Government in 1890 again acted on its own motion, and finding saccharimetry ineffectual, at last adopted, to a certain extent, the system of refining in bond which the British sugar refiners had for twenty years been urging as the only real remedy for the evil.

The exports, which had risen to 152,000 tons in 1890-91, fell gradually to 110,000 tons in 1896-97. In the following year they rose to 146,000 tons, owing to the new direct bounty.

The monster exports of 1873-76 succeeded in entirely removing for a time British loaf sugar from British markets.

There were some who then foretold that the same would happen with other classes of British refined sugar, owing to the impending competition from the growing bounties in Germany and Austria. The following figures prove that those prophecies were not without foundation:—

Exports of Refined Sugar from Germany.

	Tons.		Tons.		Tons.
1871-72 ..	5,809	1880-81 ..	56,060	1889-90 ..	225,228
1872-73 ..	7,980	1881-82 ..	54,329	1890-91 ..	235,758
1873-74 ..	6,743	1882-83 ..	73,599	1891-92 ..	230,597
1874-75 ..	5,481	1883-84 ..	94,114	1892-93 ..	270,607
1875-76 .	7,245	1884-85 ..	107,900	1893-94 ..	261,343
1876-77 ..	11,735	1885-86 ..	86,588	1894-95 ..	391,716
1877-78 ..	22,345	1886-87 ..	154,261	1895-96 ..	407,447
1878-79 ..	30,752	1887-88 ..	152,956	1896-97 ..	426,304
1879-80 ..	34,941	1888-89 ..	179,802	1897-98 ..	503,928

Exports of Refined Sugar from Austria.

	Tons.		Tons.		Tons.
1874-75 ..	29,993	1882-83 ..	124,725	1890-91 ..	234,080
1875-76 ..	39,887	1883-84 .	137,955	1891-92 ..	227,725
1876-77 ..	38,563	1884-85 ..	111,780	1892-93 .	285,140
1877-78 ..	56,730	1885-86 ..	139,705	1893-94 ..	360,153
1878-79 ..	74,915	1886-87 ..	167,228	1894-95 ..	351,711
1879-80 ..	67,547	1887-88 ..	112,508	1895-96 ..	305,227
1880-81 ..	90,208	1888-89 ..	150,341	1896-97 ..	417,238
1881-82	100,513	1889-90 ..	245,658	1897-98 ..	460,154

In 1878-79, when the Select Committee of the House of Commons was investigating the question, and warning was given of what was about to take place, the German exports of refined sugar had risen from 5,809 tons in 1871-72, to 30,752 tons. They now amount to 503,928 tons. The Austrian exports of refined had risen from 29,993 tons in 1874-75, to 74,915 tons. They now amount to 417,238 tons. The evidence given before that committee, and the conclusions to which it came, have therefore been completely justified.

In comparing the exports of Raw Sugar from the three countries, it must be borne in mind that though the raw sugar exported from France is called raw, the greater part of it is practically refined sugar.

The following are the exports of the three countries for the last fifteen years:—

	France. Tons.	Germany. Tons.	Austria. Tons.
1883-84	42,236	.. 491,176	.. 131,019
1884-85	18,752	.. 553,793	.. 180,154
1885-86	2,782	.. 404,071	.. 126,201
1886-87 .. .	19,446	.. 489,680	.. 97,593
1887-88	3,945	.. 344,710	.. 52,721
1888-89	41,447	.. 412,424	.. 123,484
1889-90	119,714	.. 493,830	.. 139,511
1890-91	179,990	.. 488,240	.. 215,367
1891-92	147,589	.. 436,671	.. 214,518
1892-93	88,526	.. 424,744	.. 164,498
1893-94	139,585	.. 436,674	.. 89,910
1894-95	147,364	.. 609,662	.. 62,095
1895-96	85,206	.. 504,444	.. 165,787
1896-97	112,256	.. 760,657	.. 101,485
1897-98	306,418	.. 478,941	.. 31,449

The French exports went up, as soon as the indirect bounty of 1884 had had time to develop, from an average of 21,000 tons in the six years 1883-89, to an average of 127,500 tons in the eight years 1889-96. In the year 1897-98, the first year of the additional direct bounty, they jumped to 306,000 tons.

The higher bounty on refined is producing the effect of reducing Austrian exports of raw sugar, which in 1896-97 were only 101,000 tons against 503,000 tons refined. The German exports of raw sugar are also falling below those of refined, as will be seen on examination of the tables. The two countries in 1896-97 exported together 843,000 tons of refined, and 860,000 tons of raw sugar, forming one-fourth of the rest of the world's consumption.

The next division of the subject was the cost of production, and the lecturer referred to the effect of the bounties on the production and export of beet sugar, and proceeded to deal with the views of those who consider that the bounties were only a minor factor, pointing out that they have been the salvation of the Continental farmer wherever the beet industry existed, by rendering high farming necessary, resulting in improved crops of the cereals forming part of the rotation. Other advantages have been the supply of valuable cattle food in the refuse pulp, and extra employment of both agricultural and factory hands. Mr. Martineau says:—

The cost of production of beetroot sugar depends on the yield of roots per acre, the yield of sugar from the roots, the cost of cultivation per acre, and the cost of extracting the sugar from the roots. In all these points Germany is ahead of her competitors.

The following figures give the quantity of roots produced per hectare ($2\frac{1}{2}$ acres) in France and Germany in each of the last seventeen years:—

	France. Tons of Roots per hectare.	Germany. Tons of Roots per hectare.
1881-82	33·791	28·3
1882-83	34·928	34·4
1883-84	35·356	29·9
1884-85	31·289	32·9
1885-86	29·457	30·2
1886-87	31·900	30·0
1887-88	22·469	26·4
1888-89	24·537	28·2
1889-90	32·364	32·9
1890-91	29·319	32·8
1891-92	25·119	28·2
1892-93	25·605	27·9

	France. Tons of Roots per hectare.		Germany. Tons of Roots per hectare.
1893-94	23·863	....	27·5
1894-95	29·553	....	32·9
1895-96	26·434	....	31·0
1896-97	27·477	....	32·3
1897-98	27·708	....	31·3
Average of the last 13 years.	27·370	....	30·0

Up to 1885 France was growing poor roots, and consequently produced a larger tonnage of roots to the acre. Since 1885 she has been under the German system, which involves small rich roots, but has only succeeded in the thirteen years in producing an average of 27·37 tons to the hectare, against an average of 30 tons produced in Germany during that period.

If we take the quantity of sugar produced each year, and divide it by the number of hectares cultivated, we get a still more striking illustration of the superiority of Germany:—

	France.		Germany.	
	Hectares.	Sugar per Hectare.	Hectares.	Sugar per Hectare.
		Tons.		Tons.
1871-72	156,700		110,303	
1872-73	190,000		125,413	
1873-74	184,000		129,733	
1874-75	209,000		133,822	
1875-76	214,000		142,023	
1876-77	115,000		140,790	
1877-78	185,000		149,633	
1878-79	200,000	1·83	160,154	2·7
1879-80	129,000		190,684	
1880-81	153,000		193,308	
1881-82	190,300		221,623	
1882-83	206,000		254,278	
1883-84	206,800		298,271	
1884-85	148,800		316,191	
1885-86	112,800		234,116	
1886-87	155,800		276,889	
1887-88	161,300		263,786	
1888-89	172,200		280,361	
1889-90	206,200		298,560	
1890-91	221,600		329,917	
1891-92	222,900	2·63	336,454	3·8
1892-93	217,600		352,015	
1893-94	220,000		386,481	
1894-95	241,500		441,441	
1895-96	204,600		376,669	
1896-97	246,204		424,881	
1897-98	231,050	3·15	437,174	4·3

It will be seen then that Germany now averages 4·3 tons of sugar to the hectare (1·72 ton to the acre) and France 3·15 tons to the hectare (1·26 ton to the acre).

The average of sugar per acre for each of the six principal beet-producing countries is given as:—

Germany	1·71	France	1·24
Belgium	1·55	Austria	1·09
Holland	1·29	Russia	0·80

which worked out according to the proportional crop of each comes to an average production of 1·327 tons per acre.

Mr. Martineau proceeds to compare this with the results obtained in tropical countries with cane sugar, and quotes figures derived from various sources for the following countries:—

	Tons per acre.		Tons per acre.
Trinidad	1·54	Java	3·2
British Guiana	1·82	Queensland	1·8
St. Lucia	1·75	Hawaii	3·6
Barbados	1·89		

As regards Cuba the average of Java is exceeded on some estates, and in Java as much as four tons to the acre was not uncommon last year. This, however, was a special season. On the whole an average of two tons per acre for all cane sugar countries would, Mr. Martineau thinks, be well within the mark.

Coming to the total cost of production, and having at command undeniable statistics of the most ample kind, the lecturer assumes the cost per ton of sugar in Germany as £10, while for the other beet-producing countries of Europe it must be considerably higher. He then says:—

Turning to the cost of producing cane sugar, I find that on the leading estates in British Guiana and Trinidad the cost ranges from £9 12s. 6d. per ton down to £8 0s. 6d. In St. Lucia the cost of production on the central factory estates is stated to be £8 15s. The average of the figures I have examined comes out, for cost of production in the West Indies, at £8 16s. 8d. per ton. The expenses of estates in Queensland have lately been published. The average of eight estates, whose figures I have seen, comes out at £8 6s. 3d. per ton. From Java I have figures which show a cost of £8 10s.

A German authority gives the following figures:—

	Per cwt. s.		Per cwt. s.
West Indies	8·98	Queensland	8·05
Egypt	9·09	Hawaii	8·22

In making this comparison between the cost of production of beet and cane sugar, it is well to keep in mind the fact that while the stimulus of bounties has hastened the attainment of perfection in the cultivation and manufacture of beetroot sugar, there is still great room for improvement in cane, and that consequently the future, with a fair field and no favour, or even without it, is likely to widen the existing gap between the cost of production in the two cases.

Without going further into the matter, I think we may fairly say, in round numbers, that the whole crop of beetroot sugar costs considerably more than £10 per ton, and the whole crop of cane sugar considerably less than £9 per ton.

This means that without bounties the beetroot producers must content themselves with supplying their own markets and the neighbouring countries. With a large reduction of duty and consequent increase of consumption this change might take place without any serious shrinkage in the production.

In British markets beetroot would probably be able to a certain extent to compete with cane on equal terms, the lower freight being some counterpoise to higher cost of production.

The final section of the paper was devoted to the interesting question of price and as this will be very convenient for future reference by our readers we give it nearly at full length.

The Board of Trade give us the following average prices of sugar consumed in the United Kingdom in each year from 1872 to 1897. The prices are without the duty.

	Raw Sugar. Per cwt.		Refined Sugar. Per cwt.			Raw Sugar. Per cwt.		Refined Sugar. Per cwt.	
	s.	d.	s.	d.		s.	d.	s.	d.
1872	26	2	36	4	1885	13	10	18	2
1873	24	0	33	10	1886	13	0	16	8
1874	22	5	30	8	1887	12	1	15	8
1875	21	2	30	4	1888	13	5	17	6
1876	21	0	29	5	1889	15	5	19	8
1877	25	9	33	9	1890	12	6	16	4
1878	21	6	29	3	1891	12	10	16	6
1879	20	3	27	5	1892	13	0	17	1
1880	21	9	29	3	1893	14	2	18	4
1881	21	9	28	11	1894	11	5	15	6
1882	21	1	28	8	1895	9	7	13	4
1883	20	1	27	2	1896	10	5	13	7
1884	15	6	20	11	1897	9	0	12	3

The fall in price is very striking. In 1884 a great drop took place, and sugar had to take an altogether new level. There can be little doubt that over production of beetroot sugar brought on, somewhat prematurely, this great revolution. I shall, however, endeavour to show, from the figures of cost of production, that the abolition of bounties would not deprive the consumer—under which term I include confectioners and other large users of sugar—of the benefit of these low prices, but would probably give him a still lower level. I will even try to show that the consumer has not benefited by the low prices so thoroughly as he might have done if there had been no artificial over production. I admit that the over production precipitated the crisis, and that we probably got low prices a year or two earlier than we might have done under natural conditions. I will also admit that the fall was more sudden and exaggerated than it might have been without bounties; but that turned out to be rather a disadvantage to the consumer.

The figures for the fourteen years 1884-97 are those to which we must specially direct our attention. If we take the average of these fourteen years, we find that during that period the average price of raw sugar was 12s. 7d. per cwt.

But if we look a little closer at details, we find very wide fluctuations. I give the highest and lowest price for each year:—

Price per Cwt. of 88 Beetroot Sugar, f.o.b. Hamburg.

[From Clark & de Silva's Circular.]

	1884.		1885.		1886.		1887.		1888.		1889.		1890.		1891.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Average price..	14	0	14	0¼	12	1	11	9	14	0	16	10	12	6¾	13	6
Highest price..	18	1½	17	0	15	9	15	6	16	3	28	3	14	3	14	10½
Lowest price..	9	9	10	0	10	0	10	6	12	6	11	0	11	6	12	3

	1892.		1893.		1894.		1895.		1896.		1897.		1898.		Average 15 Years.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Average price..	13	7½	15	5¼	11	6¾	9	10½	10	6	8	10¼	9	5¾	12	6½
Highest price..	14	11½	19	0	13	1½	11	1½	12	10½	9	4½	10	3¼	—	
Lowest price..	12	5¼	12	2¼	8	6¾	8	5¼	8	7½	8	2¼	8	11½	—	

With the exception of one small rise in 1896, all these fluctuations came from the vicissitudes of the beetroot crop. The first big fall caused a sudden reduction in the production of beetroot sugar, which brought about a rise in price of 6s. 6d. per cwt. The next fluctuations were repetitions of the first. The fifth was the result of a deficient beetroot crop, which for a time doubled the price of sugar. The price of the whole world's supply of sugar is, in fact, now dependent on the beetroot crop, which constitutes about two-thirds of the visible production of the world. If there were no bounties and no artificially stimulated production of beetroot sugar this would not be the case. The work of producing sugar would be more evenly distributed, and supply would not be so dependent as it is now on the crops of one particular region.

The result of all these fluctuations is that the consumer has paid an average price of 12s. 7d. per cwt. for raw sugar, and 16s. 6d. for refined, while the unfortunate producer who enjoys no bounty has had the value of his produce forced down sometimes to 10s., sometimes to 9s., and recently even to 8s. 3d. per cwt.; with the prospect of frequent repetitions of the same process, and absolutely no security for the future.

We have seen what the cost of production is, and that cane sugar can be produced for less than 9s. a cwt. That is, it can be laid down here, at a profit, at 11s., which is 1s. 7d. below the average of these fourteen years of low prices. If cane sugar were free to compete with beetroot on equal terms, and consequently to expand its production under natural conditions, we may feel sure that during the next fourteen years we should have the average price of sugar nearer to 11s. than to 12s. 7d. If that be so, it cannot be said that the abolition of bounties would raise the price to the consumer.

But there is one reservation to be made. The abolition of bounties would raise the margin between raw and refined, perhaps as much as 3d. per cwt., which is the ninth part of a *farthing* a pound. That, I must admit, will be a permanent and inevitable result of the abolition of bounties. Bounties affect price mainly by stimulating production. That is their only effect on price so far as the producer, and practically the consumer, is concerned. But with the refiner it is quite different. The margin between the cost of raw sugar, whether that cost happen to be high or low, and the price of all the products of refining, may be put roughly at from 2s. to 3s. per cwt., according to the kind of raw used and the kind of refined produced, out of which margin the

refiner tries to extract a profit of 3d. per cwt. When bounties intervene it is clear that this little profit of 3d. per cwt. can very soon be swept away. That is all that the consumer *permanently* gains by bounties, a ninth part of a farthing a pound, an amount quite inappreciable to him.

Some go so far in the opposite direction as to imagine that bounties have created the jam and confectionery industries, and even that the welfare of those industries depends on the maintenance of bounties. A glance at the rate of increase in the consumption of this country is sufficient to refute such a grotesque idea.

	Raw Sugar.*	Refined Sugar.†	Total Consumption	Increase or Decrease.	Price of Refined Sugar.	Average Yearly Increase of Consumption.	Average Price.
	Tons.	Tons.	Tons.	Tons.	s. d.	Tons.	s. d.
1872 ..	585,296	88,287	673,583	..	36 4		
1873 ..	630,396	109,873	740,269	+ 66,686	33 10		
1874 ..	641,272	128,681	769,953	+ 29,684	30 8		
1875 ..	740,381	129,733	870,114	+100,161	30 4		
1876 ..	681,483	129,913	811,396	— 58,718	29 5		
1877 ..	751,253	162,761	914,014	+102,618	33 9		
1878 ..	680,608	154,922	835,530	— 78,484	29 3	37,038	28 10
1879 ..	821,682	143,508	965,190	+129,660	27 5		
1880 ..	786,126	145,542	931,668	— 33,522	29 3		
1881 ..	873,360	131,660	1,005,020	+ 73,352	28 11		
1882 ..	925,996	131,947	1,057,943	+ 52,923	28 8		
1883 ..	975,821	156,902	1,132,723	+ 74,780	27 2		
1884 ..	892,069	201,989	1,094,058	— 38,665	20 11		
1885 ..	899,599	255,475	1,155,074	+ 61,016	18 2		
1886 ..	731,071	307,297	1,038,368	—116,706	16 8		
1887 ..	841,174	335,242	1,176,416	+138,048	15 8		
1888 ..	802,146	334,234	1,136,380	— 40,036	17 6		
1889 ..	802,938	440,483	1,243,421	+107,041	19 8		
1890 ..	717,394	472,239	1,189,633	— 53,788	16 4		
1891 ..	760,162	555,758	1,315,920	+126,287	16 6	19,951	16 0
1892 ..	758,331	520,998	1,279,329	— 36,591	17 1		
1893 ..	727,842	569,277	1,297,119	+ 17,790	18 4		
1894 ..	643,733	690,675	1,334,408	+ 37,289	15 6		
1895 ..	790,718	700,160	1,490,878	+156,470	13 4		
1896 ..	721,262	731,740	1,453,002	— 37,876	13 7		
1897 ..	613,706	780,784	1,394,490	— 58,512	12 3		

These figures show that during the fourteen years 1872-85, when the average price of refined sugar was 28s. 10d. per cwt., the yearly rate of increase in consumption was 37,038 tons, and that during the following twelve years, 1886-97, when the average price of

* Quantities of raw sugar retained for home consumption; and

† Quantities of imported refined sugar retained for home consumption in the United Kingdom.

refined sugar had fallen to 16s. per cwt., the average yearly increase in consumption was only 19,951 tons.

If the supposed new industries; using large additional quantities of sugar, were created by bounties, they must, therefore, have been created prior to the period of low prices, 1885-97. They have apparently not even expanded during that period at so rapid a rate as they did when sugar was nearly double the price.

There can be no doubt that sugar enters largely into the production of jams, confectionery and biscuits, and that these industries have become an important addition to the manufacturing and export trade of the country. But, as I have shown, the abolition of bounties would not deprive them of their cheap and plentiful supply of sugar. In this view I am supported by the confectioners themselves, one eminent firm, writing ten years ago in reference to the sugar Convention then before Parliament, emphatically asserting that in their opinion the effect of such legislation would be "that "this kingdom would be provided with a larger, a better, a cheaper "and a more reliable supply of sugar than it has ever yet had,"

I mention this fallacy and use statistics to explode it, because it is now the only delusion left which prevents the people of this country from thoroughly disapproving of the present protection to foreign producers in British markets.

* * * * * *

The conclusions which Mr. Martineau thinks are to be drawn from his paper are given as :—

1. That production is stimulated by bounties.
2. That cane sugar can be produced cheaper than beetroot.
3. That the frequent unnatural depressions in value caused by artificially stimulated over-production, though disastrous to producers, have on the average conferred no exceptional benefit on consumers.
4. That cane sugar can be profitably produced and sold in this country at a price materially lower than the average price of the last fourteen years of alternate depressions and reactions.
5. That under free and open competition the world would cease to be dependent on the vicissitudes of the European beetroot crop.

Although there are several refineries in Cuba, the largest of which, located at Cárdenas, could in full work turn out over 135,000 tons, the total output in 1898 was only some 24,000 tons. It will probably be greater during the current year.

CRYSTALLISATION IN MOVEMENT,

By H. C. Prinsen Geerligs, Kagok Tegal, Java.

(Continued from page 320.)

III.

	Brix.	Pol.	Quotient.
Syrup	43·08	37·6	86·5
Molasses	—	—	38·0
Mixed masse-cuite	94·36	66·6	70·59

Sample taken.	Temperature.	Brix.	Pol.	Quotient.
After ½ hour	64	90·8	41·2	45·37
,, 1 ,,	64	90·48	40·6	44·87
,, 1½ hours	64	89·96	40·2	44·70
,, 3½ ,,	62	89·50	39·6	44·24
,, 4½ ,,	62	89·20	39·0	43·77
,, 5½ ,,	61	90·66	39·0	43·00
,, 7½ ,,	59·5	90·26	38·3	42·43
,, 9½ ,,	58·5	90·56	38·4	42·42
,, 11 ,,	56	90·66	38·1	42·25
,, 12 ,,	56	89·06	36·8	41·32

IV.

	Brix.	Pol.	Quotient.
Syrup	43·48	39·0	89·7
Molasses	—	—	43·0
Mixed masse-cuite	93·74	68·8	73·39

The analyses of the molasses present among the crystals proved to be as follows at the various periods :—

Sample taken.	Temperature.	Brix.	Pol.	Quotient.
After ½ hour	66	90·96	45·4	49·90
,, 2 hours	65·5	90·36	45·0	49·80
,, 4 ,,	63	89·96	44·4	49·36
,, 6 ,,	62·5	90·00	44·2	49·11
,, 8 ,,	61·5	90·00	44·0	48·88
,, 10 ,,	60	90·00	43·7	48·55
,, 12 ,,	58	90·00	43·6	48·44
,, 14 ,,	56	90·00	43·6	48·44

V.

Syrup having a higher quotient of purity (as in the former experiments) was boiled to a masse-cuite at 90 Brix., filling 70 per cent. of the capacity of the vacuum pan; molasses with a rather high quotient were gradually drawn in and evaporated to a mixed masse-cuite of 91·32 Brix., *i.e.*, less concentrated than in the former cases.

The experiment was carried out in this way to reproduce the conditions which occur when the vacuum pan is too small and frequent discharging is necessary to prevent stoppage in the house.

Analysis.	Brix.	Pol.	Quotient.
Syrup	49·30	43·6	88·4
Molasses	71·96	33·0	45·8
Mixed masse-cuite	91·32	68·4	74·9

Twenty minutes before striking, a small sample was taken from the pan, filtered through metallic gauze, and the molasses analysed. This analysis showed Brix 82·36, Pol. 48·6, Quot. 59. The masse-cuite was concentrated to 91·32 Brix, struck, and stirred during 36 hours.

Sample taken.	Temperature.	Brix.	Pol.	Quotient.
During strike	69	87·76	43·0	49·00
After 2 hours	67·5	87·60	41·6	47·49
,, 4 ,,	66	87·30	41·0	46·97
,, 6 ,,	64	87·96	40·2	45·00
,, 8 ,,	62·5	87·62	39·9	45·50
,, 12 ,,	60	87·62	38·8	44·28
,, 16 ,,	57	87·62	38·2	43·60
,, 20 ,,	54·5	86·90	37·2	42·80
,, 24 ,,	52	87·76	37·0	42·17
,, 26 ,,	51·5	87·76	36·6	41·70
Centrifugalled molasses.	—	83·56	36·4	43·58

The following conclusions may be drawn from these experiments :—

If the vacuum pan capacity is sufficient to permit a slow and concentrated boiling, the after crystallisation chiefly takes place in the pan, and the quantity of sugar crystallising in the coolers is only insignificant.

In case the vacuum pan capacity is too small, we cannot boil close, and are forced to strike the boilings in a more dilute state, in order to get the pan free for a new boiling as soon as possible. Under these circumstances the crystallisation in the coolers is much more considerable, as is shown in No. V.

By stirring and cooling for a long time, more sugar will crystallise out than when this operation is only conducted during a short period. When the aim is to obtain all the available sugar in one operation, we cannot let pass any opportunity of crystallisation, and capacious cooling accommodation is necessary to obtain also the last crystallising portions of the sugar.

If, however, we content ourselves with a first molasses with a quotient of 40·45, it is not necessary to stir a very long time, as the

same effect may also be obtained by drawing in a little more molasses and boiling a little longer.

With a large vacuum pan the after crystallisation may already be to a large extent completed in the pan, and the coolers only keep the mass in movement until it can be cured. This constant movement is indispensable, for the molasses continually deposit small quantities of sugar, which in rest would cement the sugar crystals together, forming a sticky mass, and causing a great obstacle to proper curing.

As this movement acts exclusively as a preventive of this formation of false grain, we do not need to keep the cooler in motion for several hours, but can proceed to centrifugal as soon as we think fit.

Crystallisation in movement can likewise be applied to after-products. According to an article in the *Deutsche Zuckerindustrie*,* this process was first of all used in the Western Sugar Refinery at Amsterdam, but is now in operation in several other factories. It is very much like the Grossé process lately referred to in this journal.†

The first molasses, with a quotient of from 65 to 67, are grained in a special vacuum pan, concentrated, and struck in an apparatus for crystallisation in movement, which is caused to revolve a few times a day during a few hours. After some two or three days the cooled second-boilings masse-cuite is centrifugalled.

While under the old and still much used system the molasses require repeated boiling, cooling, and curing before they could be fully exhausted, this result is now obtainable in one operation, as is shown by the following tables, in which again the figures refer to the molasses occurring among the sugar crystals in the masse-cuites.

I.

Molasses having a quotient of 66·6 was grained in the special pan, discharged into the coolers and stirred occasionally during the day.

The analysis of the masse-cuite was Brix. 96, Pol. 64, Gluc. 11·11, Quot. 66·66, and that of the molasses at the end of the various indicated periods was :—

Sample taken.	Temperature.	Brix.	Pol.	Gluc.	Quotient.
On striking	73	.. 93·2	.. 40·0	.. 18·18	.. 42·91
After 12 hours	63·5	.. 91·9	.. 35·6	.. 19·22	.. 38·73
,, 48 ,, ...	51	.. 91·4	.. 32·8	.. 20·16	.. 35·88
Centrifugalled molasses	—	.. 85·8	.. 33·6	.. 19·37	.. 39·16

The masse-cuite being too stiff and therefore requiring too much water for "covering," the next experiments were boiled more open.

* *Deutsche Zuckerindustrie*, 1898, 851. † *International Sugar Journal*, 1899, 146.

II.

Analysis of the masse-cuite: Brix. 91·3, Pol. 61·4, Gluc. 10·34, Quot. 67·2.

Sample taken.	Temperature.	Brix.	Pol.	Gluc.	Quotient.
On striking	72	.. 88·4	.. 48·6	.. 14·04	.. 54·97
After 12 hours	64	.. 86·4	.. 43·2	.. 15·47	.. 50·00
,, 36 ,, . ..	53	.. 85·9	.. 41·2	.. 16·18	.. 47·84
,, 60 ,, ...	46	.. 85·0	.. 39·2	.. 17·0	.. 46·11
	41	.. 84·5	.. 37·8	.. 17·60	.. 44·73
Centrifugalled molasses	—	.. 85·7	.. 38·6	.. 17·18	.. 45·04

III.

Analysis of the masse-cuite: Brix. 92·6, Pol. 59·2, Gluc. 12·25, Quot. 63·93.

Sample taken.	Temperature.	Brix.	Pol.	Gluc.	Quotient.
On striking	72	.. 91·3	.. 45·0	.. 16·12	.. 49·28
After 24 hours..	60	.. 89·7	.. 36·8	.. 18·31	.. 41·02
,, 48 ,, ...	51	.. 88·9	.. 34·0	.. 19·22	.. 38·24
,, 72 ,, ...	44	.. 88·6	.. 32·8	.. 20·83	.. 37·02
,, 96 ,, ...	39·5	.. 88·3	.. 31·2	.. 21·27	.. 35·33
Centrifugalled molasses	—	.. 87·4	.. 34·0	.. 19·84	.. 38·90

IV.

Here the molasses were diluted to 60° Brix before being drawn into the pan and the masse-cuite boiled closer. Analysis of the masse-cuite: Br. 93·8, Pol. 62, Glucose 10·75, Quot. 66·09. The grain was very coarse.

Sample taken.	Temperature.	Brix.	Pol.	Gluc.	Quotient.
On striking	68	.. 91·6	.. 40·6	.. 18·05	.. 44·32
After 24 hours	56	.. 90·4	.. 37·6	.. 19·84	.. 41·59
,, 48 ,, ...	49	.. 90·0	.. 36·0	.. 20·40	.. 40·00
Centrifugalled molasses.	—	.. 89·2	.. 35·2	.. 17·30	.. 39·46

V.

Just like No. IV., but very small grain. Analysis of the masse-cuite: Br. 94·8, Pol. 62·4, Glucose 11·57, Quot. 65·82.

Sample taken.	Temperature.	Brix.	Pol.	Gluc.	Quotient.
On striking	70	.. 93·3	. 42·6	. 20·16	.. 45·65
After 24 hours	58	.. 91·6	.. 36·4	.. 21·73	.. 39·73
,, 48 ,, ...	49	.. 91·0	.. 33·2	.. 22·72	.. 36·48
,, 72 ,, ...	42	.. 90·4	.. 31·6	.. 23·14	.. 34·95
Centrifugalled molasses.	—	.. 87·7	.. 41·6	.. 16·18	.. 47·43

VI.

In order to check the results obtained by graining the molasses the masse-cuite was this time boiled to string proof and treated just like the other masse-cuites. It was of course impossible to concentrate it

so far as the grained masse-cuites. Analysis of the masse-cuite: Br. 91·1, Pol. 60·8, Glucose 9·25, Quot. 66·73.

Sample taken.	Temperature.	Brix.	Pol.	Gluc.	Quotient.
On striking	70	.. 91·1	.. 60·8	.. 9·25	.. 66·73
After 24 hours	56	.. 86·8	.. 46·8	.. 11·62	.. 53·91
,, 48 ,, ...	47	.. 86·0	.. 45·2	.. 12·82	.. 52·55
Centrifugalled molasses.	—	.. 85·9	.. 42·8	.. 13·92	.. 49·82

In the experiments of this series the total amount of the masse-cuite was originally from an impure juice, and hence contained much more non-sugar than when molasses are drawn into a ready masse-cuite from pure syrup. For the same reason the viscosity was much greater, preventing the concentration from being carried so far as in the first series.

Besides, the crystallisation was much slower in the second series, and hence the masse-cuite came into the coolers with a much higher quotient of supersaturation, and only parted with its crystallising sugar after a much longer period of stirring and cooling.

In regard to the course of crystallisation, the results obtained by the crystallisation in movement of seconds fully agree with those indicated by the experiments with crystallisation in movement of first sugar masse-cuites.

The possession of an ample supply of molasses, which can be boiled to grain, is the *conditio sine quâ non* for the crystallisation in movement of second sugars. As soon as the grain is formed poorer molasses may be added to feed the already existing grain.

Factories in which white sugar is made can easily fulfil this condition, and for these the crystallisation of movement of second sugars will be even more valuable than the crystallisation in movement of firsts, as this process is apt to impart a yellowish tinge to these latter, reducing their commercial value.

There are in Roumania three sugar factories: Chitila (started afresh in 1898), Sascut (1884), Marasesti (1898); the respective turn out being 2,000, 5,000, and 4,000 tons. A new one, to turn out 7,000 tons and expected to be at work in 1900, is being constructed at Romane by the "Maschinenfabrik Grevenbroich." The total production will then be 18,000 tons, which will suffice for the requirements of the country.

COST ACCOUNTS OF SUGAR ESTATES.

It is to be regretted that diversity of practice, as much as the different conditions that obtain in sugar producing countries, makes the comparison of statements of cost of production an impossible guide to the sugar grower and manufacturer, as to where the widest margins for economies exist.

Thanks to the recognition of the scientific principles involved in manufacture, the amount of sugar contained in a given quantity of canes, the percentage of extraction obtained by the mill, the loss occurring in the factory, and such like particulars for checking the efficiency of manipulation and of the processes employed are available in a well conducted factory, for detecting faulty work, and for indicating the direction in which improvement may be effected. In the case of such data as these, not only is the comparison between one estate and another valuable, but also that between the results obtained in different countries. In the matter of costs, however, a difficulty presents itself at the outset. When it is stated that a ton of sugar, reduced to 100° polarization, has cost a certain amount to produce, it is not at all clear what expenses are proportionately included in that sum, and a similar remark applies to the cost of growing a ton of canes. Assuming that the figures have been prepared in a manner such as to inspire confidence in their accuracy, the first thing to be considered is the personal factor in the one who prepares them. Take the case of a Demerara estate belonging to a private proprietor, in the days when sugar property returned to the owner an annual income of a magnitude altogether disproportionate to the capital represented by the value of the estate, with its buildings and machinery. The manager was the despotic ruler of his little kingdom; so long as the annual revenue was maintained at a respectable figure, he was allowed to do pretty much as he liked. The man who could make the property pay handsomely was assured of a fixed salary and unlimited perquisites. The place was almost as fully under his control as if he had been lessee, and had paid an annual rent to the landlord, but under the conditions then existent he was in many respects even better off, as he was protected against personal loss resulting from bad seasons or unforeseen events. For his risk, as it were, the owner controlled the estate only so far as to decide on the more important items of expenditure such as a new draining engine or a larger cane-mill,—the outlay on which, of course,

came out of his pocket. While the owner was satisfied with what he was getting out of his property, and the manager was equally content, they had no object in keeping detailed costs—every hour that the manager or one of his assistants spent in keeping any but the most necessary accounts, would have been unproductive labour, which could more advantageously be directed to practical supervision where the results were more direct and apparent; hence the common saying, "I am here to grow canes, not to grow figures." As the price of sugar fell, and new processes were introduced, old practices had to give way to new circumstances. The feudal ideas of the past yielded to a condition more approaching the modern industrial system. The landlords' annual revenues were curtailed, and they awoke to take a more detailed interest in their estates, and their more active measures had corresponding influence on the local management. An estate which in a few years had returned its first cost might, from one point of view, be safely abandoned. But again, regarded as a concern to be valued at the capitalized interest which it returned, it was still a valuable asset. In order, however, to keep it going, obsolete processes had to be replaced by modern methods, while the machinery required putting in order, thereby involving further outlay. In the smaller West Indian Islands the estates had had their day, and their decline and fall was only a question of time; in Demerara, those which were virtually abandoned by their owners were absorbed in others, which in consequence grew in importance. Their managers were no longer in the position of tenants of an over-lord, but they were men employed to further the direct interest of the owners; their own perquisites in the shape of pasturage fees, keep of live stock, and so forth, were either directed into the proprietors' coffers or altogether suppressed. The new conditions demanded a more accurate system of record, to which they were unaccustomed, and the principles underlying practice had to be defined. A cost account furnished by such men is necessarily evolved from their own view of affairs, and may possibly be coloured by the natural desire to represent matters in the most favourable light. On so many acres, a certain sum is spent in labour and fertilisers, the crop is reaped, and the canes are made into sugar at a certain expenditure; the whole sum of money passing through the manager's hands—the total expenditure for which he is responsible—divided by the number of tons of sugar he ships in the year represents to him the cost per ton of production. His weekly wages-bill is defrayed out of pasturage fees for the labourers' cattle,

the rent of shops on the estate, the sale of timber, and so forth, as well as by cash received from the bank. He does not make any nice distinction as to the source from which the money is derived to meet the expenditure, and it does not occur to him to regard the rents derived from "farmers'" provision grounds, the cocoa-nut trees on the estate's dams, etc., as separate concerns conducted under the same management. True it is that they are as much a source of revenue as are sugar, rum, and molasses—the main products of his operations—but unless these complex factors be eliminated, the comparison of cost between sugar growing in different countries is valueless.

Less likely is the manager to take the owner's view of the cost of production, or, if he does, to fully grasp it, for the matter involves some theoretical knowledge of accounts, and it is in human nature for the practical man and the theorist to mutually despise one another. Few and far between are the men who combine practice and theory in just proportions. The more the owner regards his property as an industrial concern, the more careful is he to make his private accounts conform to recognised business methods; when, as is now frequently the case, an estate is owned by a Limited Liability Company, such practice is imperative. A most important matter is the question of repairs, renewals, and depreciation of plant, machinery and buildings. Ordinary maintenance and repairs sufficient to keep things in going order fall within the province of the manager, and are met from current expenditure. But the erection of economical machinery and appliances in the place of those which have become obsolete, and the renewal of boilers, for instance, whose "life" is at an end, are virtually as much a part of the cost of production as the labour spent on growing the canes. To deal with the matter satisfactorily involves considerable difficulty, and the profit and loss account may be manipulated to any extent by errors of judgment or through inadvertency. To value the whole of the buildings, plant, and machinery, at one or more fixed sums, and annually to write off a percentage, appears to be a very indefinite and unsatisfactory method. A more detailed classification with various rates of percentage would be far less liable to mislead. The special circumstances which may affect and reduce the "life" of the individual appliances in a factory demand consideration, and provision should be made for rapidly writing off such machine as may soon become obsolete. It needs little knowledge of practical conditions to realize that the cane-

mill, the vacuum-pan, the centrifugals, the boilers, cannot reasonably be expected to have an existence of equal duration. Again, where old fashioned systems of dealing with scum and refuse exist, and the advisability of installing new filter presses is apparent, or where the evaporating apparatus is inefficient and it is determined to replace it with multiple-effets of the most improved construction, it is readily seen that the out-of-date appliances should assuredly not be allowed to swell the value of the plant and machinery beyond the proper amount, as they very likely may do if not dealt with individually. A general depreciation account may be useful in dealing with minor matters such as the renewal of the steam-pipes throughout the factory or the purchase of new cane-rollers, but is out of place where machines and appliances are affected in their entirety. Depreciation, however, is something more than a matter of account; it can only be satisfactorily dealt with in conjunction with those who have intimate knowledge of the particular buildings, plant and machinery under consideration.

The importance of the subject is so much a matter of course, and its necessity so apparent to those familiar with commercial management, that it is almost inconceivable to them that it can be overlooked. But when it is remembered that the modern sugar factory, with its costly machinery, is a development of the crude ordinary process, it is, after all, hardly to be wondered that the old-fashioned planters, steeped in the traditions of the past, fail to realise all that is dependent on the innovations they have witnessed.

It would be tedious to deal seriatim with all the general heads of expenditure in considering the cost of production of cane sugar, and it is quite sufficiently suggestive to indicate how varying practices and different views not only largely influence the resultant figures, but make comparisons almost useless.

It will, however, be as well to deal briefly with one or two matters of less general bearing, with a view to the varying factors which affect perhaps the same man's computations under different conditions. Firstly, we will consider what is an "acre of canes." An English schoolboy would tell us that an acre contains 4840 square yards, or 10 square chains, but a Demerara boy would say it contains 300 square rods. As the exact length of the rod used in Demerara is 12 feet 4 inches, a simple calculation shews a wide variation between the acres in Demerara and those commonly assumed; and when it is considered that the "acreage" in canes is a considerable amount, it will be seen that 1000 acres of canes in Demerara covers a much

larger surface than 1000 acres in other places where the English acre is the basis. Nor is this all. The fields on some estates being bounded by canals, they are reckoned from centre of canal to centre of canal, while on others the bare surface covered by canes is taken. The former practice shews a lower cost of tillage per acre, the latter a better yield.

Next to be considered is the duration of time necessary to grow the crop. In some countries, where it is customary to replant annually, and where the canes take long to mature, the same soil will only yield a crop every two years, or, what is the same thing, half the estate only is reaped every year. In Demerara, where canes arrive at maturity quickly, and "ratooning" is practised extensively, it is quite possible for the whole estate to give an annual crop. Assuming, however, that it is considered advisable to ratoon only four times, one-fifth of the total acreage requires replanting every year. The unavoidable delays attendant on the process, and the additional time required for "plants" to arrive at maturity, therefore make it only possible, roughly expressed, to reap four-fifths of the estate yearly. Of course, matters are not in practice arranged with such nicety, but similar conditions and varying seasons cause the total acreage reaped yearly to be different in different years, even when there is neither any abandonment of existing fields, nor extension of the cultivated area. The time has, perhaps happily, gone by when the "year" had elastic limits to suit the exigencies of the crop.

Abandonment and extension are also certainly factors that must not be lost sight of in computing cost of production. Where new land is first brought into cultivation the yield is high, but the expense of "empoldering" in Demerara is a heavy item, while it constitutes a permanent improvement to the estate. Where, however, a corresponding acreage is abandoned, it bears much the same relation to general expenditure as does the renewal of obsolete plant in the factory.

Bearing in mind, then, all the many conditions that obtain on a sugar growing estate, the different practices in different countries, and the various ideas which exist as to what is implied when the cost of production is mentioned, it appears almost hopeless at present to use the figures of one country as a guide to what is possible in another. When any tabulated results are presented, or generalisations given, it should be distinctly stated whether they are intended to represent what may be called "working expenses," or whether they are "total

charges," and even then due allowance should be made for local practices and variations. The matter is one of extreme importance, as on financial results—frequently on a very narrow margin of profit—the very existence of the cane sugar industry in some countries depends. Everything that can throw additional light on the subject is desirable, and though the conclusions arrived at in the present article may not be very definite, it is hoped that by suggestions arising from consideration of the diversified practice, published statements may be more sympathetically analysed, if more critically examined, to the ultimate advantage of sugar producers at large.

LORD FARRER ON THE ABOLITION OF THE SUGAR BOUNTIES.

To the Editor of the "International Sugar Journal."

Sir,—On the day when my paper was read at the Statistical Society, the following letter from Lord Farrer was addressed to me at the office of the Society, and would no doubt have been read at the meeting if I had been present.

I think it and the brief correspondence to which it gave rise are worth publication, as giving Lord Farrer's views in a nutshell.

The first letter was evidently intended for publication, and I have no reason to suppose that there would be any objection to the addition of the others.

Yours faithfully,

George Martineau.

June 7th, 1899.

Abinger Hall,
17th April, 1899.

My dear Mr. Martineau,

I have read your paper this morning with very great interest; it contains a great deal which will be of much use to us all. You will forgive me for doubting whether without bounties there would have been little or no beetroot sugar; and whether without beetroot sugar the world would have been as well supplied as it is.

But what surprises me most is that you and those who wish to put an end to bounties do not see that the whole drift of your paper is to make the Protectionists, who are in a majority in France and Germany, fight for their absurd system harder than ever. They will

say, "see how much harm our bounties do to England; they must therefore be good for us. The Free Trade gospel is only a fraud of 'la perfide Albion'; let us stick to our bounties, and let them retaliate."

To my mind, you and your friends are very nearly as suicidal as French and German Protectionists.

Sincerely yours,

FARRER.

GEORGE MARTINEAU, Esq.

Gomshall Lodge,
20th April, 1899.

Dear Lord FARRER,

Thank you for your kind note of appreciation, which has just reached me from the Secretary of the Society.

I did not infer from the facts of my paper that "without bounties there would have been little or no beetroot sugar." On the contrary, I showed that the French Fabricants, when entirely devoid of bounties, succeeded in producing during the fourteen years, 1872-1885, an average of 325,000 tons per annum.

I wrote my paper from a purely scientific point of view, and endeavoured to put the facts as impartially and honestly as I could, without regard to what effect they might have either here or abroad. I do not think I have encouraged the foreign protectionist party to "fight for their absurd system harder than ever." I certainly have not done so by showing "how much harm the bounties do to England," because that is just the part of the question which I have carefully omitted from the paper. If I have done anything "suicidal" to the interests of my friends it is by showing the foreign protectionists that when they abolish their bounties they will have to reduce their duties and increase consumption if they wish to maintain their sugar industry on its present scale. But I do not fear that plain speaking such as this will tempt them to maintain bounties when other and more urgent reasons may lead to their abolition. France is losing a hundred million francs a year and *must* take steps to reduce the loss. The French Government have already warned the Fabricants of an impending change. Monsieur F. Sachs, in the *Sucrerie Belge*, says that the French manufacturers must know that the reduction of their enormous bounty is only a question of time, and that therefore the French delegates at the Conference made a great mistake in deliberately wrecking the proceedings. Instead of that, they ought to have availed

themselves of the special concessions made to them while all the other countries undertook to abolish their bounties. They now begin to see the error they have made. The *Sucrerie Indigène*, an organ of the French sugar industry, is even more emphatic. It asks what France is going to do now; will she be as impracticable and obstinate as before? "Since the Conferences, and in spite of the obstinacy of the French delegates, our situation has been modified, and, without having received from others anything in exchange, we have been the first to reduce our export bounties, though no one asked us to do so. Only recently a demand was made that the *prise en charge* should be raised or the bounty on the excess yields reduced. At this rate we shall be giving more than the Brussels Conference demanded of us." The *Sucrerie Indigène* thinks, therefore, that the time has come for a change of attitude and a readiness to examine the proposals of the Conference. The Belgian paper, quoting these passages, concludes that "it may not yet be too late to arrive at a rational solution which may satisfy all the producing countries of Europe."

M. Dureau, the Editor of the *Journal des Fabricants de Sucre*, begins to regard the matter from the same point of view, when he admits that "bounties constitute a deplorable method of competition, and that if production goes on developing in all countries they must evidently end by having no further object."

I give you these quotations in order to show that the feeling abroad is not quite what you suppose it to be. I think I have shown sufficiently clearly in my paper that if the war of bounties continues it will be solely owing to the struggle between France and Germany for supremacy in the sugar market. A second struggle is going on between Austria and Russia for the Eastern trade.

I am, dear Lord Farrer,

Yours very truly,

GEORGE MARTINEAU.

I presume that you wished your letter read as part of the proceedings.

Abinger Hall,

22nd April, 1899.

Dear Mr. MARTINEAU,

Thanks for your quotations, I hope they indicate reviving sanity. If so I think we shall do best to let them stew in their own juice. Retaliation in the way of reciprocity; the preaching of the Cobden

Club in America; and even the French Treaty, did, in my opinion, more harm than good to the cause of Free Trade, by leading Foreign Protectionists to believe that we did not ourselves believe in the faith we professed.

Sincerely yours,

FARRER.

Gomshall,

April 24th, 1899.

Dear Lord FARRER,

Thank you for your note of the 22nd. As you know, I do not admit that abolishing bounties is Retaliation. Nor do I admit that a desire to have bounties abolished shows any want of faith in our Free Trade principles.

I wrote in reply to these two points ten years ago:—

"Parrying a blow is not retaliation. Protection to foreigners *on British markets* is against our Free Trade principles, and contrary to justice and our own interests. We therefore enter into a convention with certain countries to secure the abolition of this protection. But the foreign Governments naturally point out that they cannot enter into this arrangement unless they have some security that they, in their turn, will not have to compete with bounty-fed sugar. It would be impossible to make a treaty without such security, and as the object of the treaty is the abolition of the most aggressive kind of protection there can be nothing of the nature of retaliation in giving the required security in order to obtain a general agreement for the abolition of the protection."

If Free Trade means that we shall not protect our own producers by creating an artificial price for their produce, it must also mean, still more strongly, that we shall not permit Foreign Governments to protect their producers, by creating for them an artificial price *in British markets*. They may protect them at home as much as they like, but when they proceed to protect them in our markets, they are making an attack on British industry and commerce *on British territory*. We have a constitutional right to demand free and open competition *in our own markets*, and we do not get it so long as we permit foreign producers to be protected there by bounties.

When I wrote my paper for the Statistical Society I naturally confined myself to statistics; and therefore, at the conclusion of the

paper, I deprecated any desultory drifting of the discussion into the regions of political economy. But I am quite ready to treat the subject from that point of view if it is the wish of the Society to deal with that aspect of the question. Nothing would give me greater pleasure.

Believe me, dear Lord Farrer,

Yours very truly,

GEORGE MARTINEAU.

Abinger Hall,
26th April, 1899.

Dear Mr. MARTINEAU,

We shall not agree. Your countervailing duty is retaliation, only it is retaliation on what is on the whole a benefit to the English people!

As to attacking us in our markets, the argument will not hold water for a moment. There is not a protective foreign duty, indeed there is no foreign duty whatever, which does not affect the price of sugar in our markets.

If France, Germany, etc., adopted a reasonable system of taxation; still more, if they abolished sugar taxation, it would do more to alter prices than all the bounties in the world, or their abolition, would ever do.

But I return to my point. You are suicidal. If you wish foreign nations to abolish bounties, let them stew in their own juice. Do not make them think that we think that bounties hurt us and benefit them.

Sincerely yours,

FARRER.

Pursuant to agreement with the Queensland Factories the Colonial Sugar Refining Company has exported to British Columbia, Hong Kong, London, and Japan some 16,500 tons of sugar, on which it is expected there will be a slight loss. Of the shipments to Japan (358 tons) 8 tons were refined sugar, sent with a view of testing the market.

A NEW MODIFICATION OF CLERGET'S METHOD, SPECIALLY APPLICABLE TO AFTER-PRODUCTS AND MOLASSES.

By ARTHUR R. LING and JULIAN L. BAKER.

(Journal of the Society of Chemical Industry.)

(Continued from page 330.)

It was obviously necessary to ascertain if the value obtained for the rotatory power of invert sugar produced by the Herzfeld-Clerget's method was true for invert sugar obtained by the action of yeast. We were fortunate in securing from a sugar refinery three samples of refined sugar, which for convenience we may denote as A, B, and C. These were analysed by the usual method, with the following results:—

		Per cent.	Specific Rotatory Power in Laurent Polarimeter. C. = 15.
Sample A	Saccharose........	99·910	
	Ash..............	0·033	
	Water............	0·050	$[\alpha]_D = 66{\cdot}43$
		99·993	
Sample B	Saccharose........	100·000	
	Ash..............	0·013	
	Water............	0·027	$[\alpha]_D = 66{\cdot}53$
		100·040	
Sample C	Saccharose........	99·920	
	Ash..............	0·003	
	Water............	0·017	$[\alpha]_D = 66{\cdot}50$
		99·940	

Now it was certainly to be expected that Herzfeld's value for the rotatory power of invert sugar would also be obtained when the inversion was carried out with yeast. Having regard to the purity of the three samples above mentioned, which are, however, merely typical refined sugars, we decided not to attempt any purification, but merely to dry off a portion used for experiment at about 50° C.

The method adopted is as follows: The quarter-normal weight (6·512 grms.) of sugar is rinsed into a 50-c.c. measuring flask with about 20 c.c. of water. The sugar is dissolved, and the temperature of the solution raised to 55° C., after which about 0·5 grm. of fresh pressed and washed brewery yeast is added. This is best done, when

several experiments have to be carried out, by suspending a known weight of the yeast in a definite volume of water, and adding a certain amount of this suspension to the sugar solution by means of a pipette. We have satisfied ourselves, by conducting blank experiments, that no optically active substances pass into solution during the digestion of the sugar solution with the yeast. The inverted solutions were polarised in a water-jacketed 200 mm. tube at a definite temperate, which was determined by means of a thermometer reading to 0·1° C. When the readings were made at any other temperature than 20° C., they were duly corrected to this.*

Experiment.	Sample used.	Inversion Constant $I_{20°}$.	Remarks.
1	A	— 32·67	Fresh yeast.
2	A	— 32·52	,, ,,
3	B	— 32·57	,, ,,
4	B	— 32·50	,, ,,
5	C	— 32·67	,, ,,
6	C	— 32·67	,, ,,
7	A	— 32·47	,, ,,
8	A	— 32·47	,, ,,
9	A	— 32·46	Yeast two days old.
10	B	— 32·64	,, ,, ,,
11	B	— 32·48	Yeast six days old (liquefied).

The mean of these 11 experiments gives an inversion constant of $I_{20} = -32{\cdot}56$, instead of — 32·66, as observed by Herzfeld. Bearing in mind the fact that the experiments were made with refined sugar without any subsequent purification, we consider we are justified in adopting Herzfeld's formula for calculating the results, the more so as one of us, using sugar purified by treatment with alcohol and inverting with acid, has confirmed Herzfeld's value.*

We will now record some values obtained with commercial samples, and we may state that of these we have selected only those referring to dark products, in which it is impossible to obtain concordant values by the ordinary process with acid. We at first attempted to act on solutions which had been previously clarified with basic lead acetate, filtered, and rendered slightly acid with acetic acid, but we found that the presence of lead entirely arrests the invertive action of the yeast. All our experiments were made therefore on unclarified solutions.

The ¼ normal weight is dissolved in about 20 c.c. of water, the solution rendered slightly acid with acetic† acid if necessary, heated

*See *International Sugar Journal*, pp. 266—270.

† We would insist on the necessity of acidifying the solution, when necessary, with an acid which is known to exert no retarding influence on the hydrolytic function of invertase; such an acid is acetic acid. In the absence of data as to their action, we have avoided the use of stronger mineral acids.

to 55° C., and 0·5 grm. of yeast added. At the end of five hours, basic lead acetate and a little alumina are added, the solution diluted to 50 c.c., and polarised in a 200 mm. tube at a known temperature. We are aware of the objections against clarifying a solution of invert sugar with basic lead acetate, and a better plan would probably be that recommended by Herzfeld (Zeit. Ver. Rübenzuck. Ind., 1890, 208), namely, to clarify the solution by the addition of 0·38 grm. of extracted charcoal after making it up to the mark, a correction being applied for the absorptive power of the charcoal in the time it remains in contact with the solution, by means of a factor ascertained by a separate experiment with a solution of pure invert sugar.

Having regard to the nature of these products, all of which, with the exception of the last sample of "cane molasses," were *very* low grade samples, we think we are justified in concluding that the agreement between the duplicate determinations is satisfactory. The fact that the values obtained with acid do not agree with those obtained with yeast, may, we contend, be taken *a priori* to be due to the defects already pointed out in connection with the former process.

Description of Sample.	Direct Polarisation, P.	Clerget (Acid).		Clerget (Yeast).	
		Inversion Value, $I_{20°}$.	Saccharose.	Inversion Value, $I_{20°}$.	Saccharose.
Beetroot molasses..	51·5	−14·00	49·0	−14·83	50·10
Same sample	51·8	−14·29	49·7	−15·30	50·60
Jaggery	72·9	..	..	−18·12	68·60
Same sample ..	..	..	..	−17·38	68·10
Egyptian molasses..	28·3	..	..	−16·20	33·54
Same sample	..	..	..	−16·00	33·39
Egyptian molasses..	28·3	..	..	−16·90	34·07
Same sample	..	..	..	−16·50	33·80
Egyptian molasses..	28·4	..	..	−15·94	33·40
Same sample	..	..	..	−15·42	33·10
Cane molasses* ..	42·4	−15·76	43·8	−14·92	43·20
Same sample	..	..	..	−14·90	43·19

In conclusion, we may add that although the yeast inversion process extends over more time than the ordinary Clerget method with acid, the former needs less attention; and where a great many determinations have to be made, less of the operator's time is taken up.

* Mr. A. C. Halse, to whom we are indebted for this sample of molasses, finds with acid, saccharose = 43·80 per cent., thus corroborating our value.

TRINIDAD.

The Royal Botanic Gardens.

We have received the above report for the year 1898, forming the twelfth of the series annually submitted by the Superintendent, Mr. J. H. Hart, F.L.S., during his tenure of office. The report shows that as usual active and valuable work has been prosecuted, in connection both with the sugar industry and with the so-called minor industries, which form in Trinidad a much larger proportion than in most of the other West India Islands and British Guiana. It appears that we shall have to wait until next year before we can have more exhaustive reports on the results obtained from some very promising seedling canes raised from Demerara and Barbados, as well as home-grown seed. Mr. Hart states openly that the end he has in view is the obtaining of "a hardy cane that will give a 20 per cent. field return," and judging by his past work he is not likely (if properly seconded) to give up until the end is attained, if it be within the limits of possibility. We have only space at present for the paragraphs devoted to sugar cane, which areas under.* We do not fully understand the remark that "the Bourbon planted by itself is infertile," and to prevent any misunderstanding it would have been better if the sentence had been more explanatory. We are not at all experienced botanists, much less experienced cane growers. It may be explained that in the following remarks D means Demerara, B Barbados, T Trinidad.

"The experimental cultivation of the Demerara and Barbados seedlings has been continued at St. Clair. A large number of both have been deleted, but the Demerara seedlings have so far proved the better of the lot. A report on the results of the trials was published in May, 1898, but as these results properly fall into the work of the year under report, a recapitulation of the principal points is given.

"The sugar cane year in Trinidad does not end until April or May, and the returns of course cannot be given until the crop is harvested. The experiments under report therefore are those of canes planted in April, 1897, and reaped in April, 1898. The next crop to be reported on will be reaped in April, 1899. A few observations on the growth of this lot since planting from cuttings in April, on 1898, are given, while the full report on the latter will be given as usual, after

*Reference may be made to the *Sugar Cane* for 1897, pp. 235-239, and 1898, pp. 356-360.

harvest. Some 2,000 seedlings were raised in the season 1896-7, out of which only 126 stools were selected for test, the remainder having to be discarded, as naturally follows where selection from seedlings is being carried on. Most of the 126 have been grown on for a second year's trial, for harvest in 1899. It has been found that there was a marked likeness to the maternal parent in many of the canes grown from seed. Those from D 95 gave stools having a high sugar value. The same feature appeared among seedlings raised from D 102, and in vegetable characters also these closely resembled their maternal parent. The sugar value of canes raised from "Caledonian Queen," considered by Harrison & Jenman to be synonymous with "White Transparent," is considerably lower than either of the foregoing. Canes raised here from seed harvested in Demerara (four) were of low sugar value. The highest sugar value was obtained from a cane raised in Trinidad (T 111) from seed of D 74, grown in Trinidad. The percentage of available sucrose in this cane was 21·3. Another cane T 2 gave 18·2 %; while the original D 74 gave 18·2 %; T 77 gave 18·3 %; T 19, 20 %; T 211, 18·8 %; T 62, 18 %; and T 43, 18·2 %. The best of the Demerara lot, so far as our experience goes appear to be D 74—D 78—D 115—D 102—and D 116. D 95 is the sweetest cane, but in vigour of growth and capability of resisting rust and other diseases, it is not equal to some of the others. I received at the end of the year three selections from the Demerara raisers, and six from Barbados. These will be grown on for comparison with those previously raised, and as guides to the value of our own seedlings. Plots of one-twentieth of an acre of the best Demerara kinds are now standing at St. Clair and show clearly the well-marked characters of each variety.

"In cane growing, as in nearly every other cultivation, every grower has his fancy. In Barbados growers appear to prefer yellow canes, and the prejudice against a coloured cane is somewhat marked. In Trinidad also the same view holds good on several large estates. Most of the Demerara seedlings of the first sets raised are coloured more or less, but later acquisitions of the yellow strain have now been secured. It would be very convenient if growers could furnish a reason for the preference of yellow over dark coloured. Of the Trinidad canes, the best so far is T 2, a coloured cane raised from Barbados seed. In our first selection from seedlings, 20 varieties gave an average return of available sucrose of 18·6 %, while standard varieties grown on the same ground gave 14·7 % only. Our seedlings

raised from seed harvested in 1897 have grown well, and we have now some 3,000 on the ground, and selections from these will be tested in April and May next. It is considered that if two good canes per thousand are secured the work is all that can be desired, and if only one good cane in every 5,000 is secured the work is highly successful; for if the end in view is ultimately attained—namely, the raising of a hardy cane which will give a twenty per cent. field return, the growth of a thousand canes more or less is a matter of little moment. So far the growth of the plant canes from the seedlings of 1896-7 is all that could be desired, but it is not expected that more than one-tenth of these will be considered fit to pass on for the third year's trial, through the absence of qualities which go to make up a "good all round" cane.

"Number T 111, the cane showing highest available yield of sugar, has done fairly well, and will stand for its second examination in April next, and will then go on for its third year's trial. Whether it will prove good enough to pass on for further trials is a question for the future; for every cane in the selector's hands must stand or fall on its own merits, otherwise there would be no regularity, and the tests would be of no value. No matter how much a cane may strike the eye, it must go to the manure heap, unless it can successfully pass repeated trials.

"The seedlings of 1897-8, (*i.e.*) seedlings raised from seeds sown November, 1897, were late in being planted, owing to the press of new work on hand, and many of them have not had a chance to make sufficient growth to show their characters well during the coming harvest. The canes on certain of the first planted areas, however, show sufficient character to enable us to judge them qualified to pass their first field test, and will come on for examination in April.

"The later growth, however, must await the following season. Not more than 5 per cent. of loss occurred from planting out the young seedlings in the field, as we took great care to well harden them previous to planting. They were attacked however by mole crickets, and many were cut when over two feet in height. A remedy was eventually devised to stop this loss. It consisted in placing a collar of bamboo over the plant, and pressing it slightly into the ground, allowing the plant to grow through, until it obtained sufficient strength to resist the attack.

"The crop of seed harvested in November, 1898, was very small,

owing principally to the transfer of the work from the old establishment, but a good germination took place and we have quite sufficient for the year's work, some 3,000 plants.

"The varieties received from the Barbados station were B 147, B 347, B 306, B 208, B 156, and B 254. Of these B 147 is very highly spoken of. It is a yellow cane of the Bourbon type, and all the others possess similar characters.

"I obtained seeds of the Bourbon Cane from various planters during the season November, 1898. In all some forty bags were received, but with all this material not a single plant was raised. Our experience goes to show that the Bourbon planted by itself is infertile.

"Close observation of the seedling canes show that they have a period of ripening, differing with each kind. Some require as much as twelve months to ripen, some fifteen months, while not a few are ready for the mill in nine or ten months of good weather. D 74—planted in April, arrowed (flowered) and produced fertile seed in November, and will be fully ripe at twelve months old. D 61, on the contrary, will not be ripe until over fourteen months old, being quite grassy up to six months old; and T 2 is of a similar character. The Bourbon, as usually planted, takes some fifteen months; in fact, it is the rule to plant in the months of October and November for the crop to be reaped some fifteen months afterwards. The cane crop in Trinidad commences some time in January, but often is not general until February and often continues until April or May.

"If a cane could be raised that would come to maturity regularly in ten or twelve months, it should be of great advantage to the sugar planter, and even if one could be obtained which would ripen in nine months, it would in many ways be a boon to the planter. Some say that this would be no advantage, as during the months previous to taking off crop, labour would be wasted if they had no planting to do, and that it is better to grow canes for fifteen months before cutting them. It would appear but reasonable, however, that where growing and manufacturing are separated, it would be better, and to the advantage of the farmers, to get their crops to maturity as quickly as possible. I find that many of the seedlings show a precocity for ripening early, and a watch will be kept to secure, if possible, any variety which may be valuable for this reason.

"A very curious kind of cane has been received from Kew called the Japanese cane. The growth, so far, is decidedly weedy, but

it shows strong vitality, and it may be found useful for bearing seed for experiment. Its sugar content will be tested in April.

"To prevent applications being made, to which we are unable to respond, it is to be noted that we have only a single plant of a seedling the first year, and some eight or ten the second year, but during the third season moderate numbers will be available for distribution. When plants of the best kinds are available they will be duly advertised, but it would not be in any way a wise proceeding to take plants on a first, or even on a second analysis, as subsequent trials might prove them completely unable to maintain any superiority which they might have shown on the first or second occasion."

KIESELGUHR (DIATOMACEOUS EARTH) AND OTHER INFUSORIAL EARTHS.

In view of the fact that this and similar substances have been and still are being used or proposed as a medium of clarification in sugar refining, the following particulars as to where it is found, extracted from the *Bulletin de l'Association des Chimistes Français*, may be of interest.

Kieselguhr is the German name of a variety of infusorial earth very abundant in the province of Hanover, formerly known as "fossil meal." It is a siliceous rock, 150 feet deep, and is formed by the accumulation of an infinite number of *diatoms*. Taken from the surface, it is white, and composed of almost pure silica; in the deeper parts it is grey and more or less contaminated with the remains of organic substances. The latter can, however, be destroyed by a moderate calcination, and the kieselguhr then acquires a colour varying between a creamy yellow and a reddish yellow, according to the quantities of oxide of iron present. The strongest acids scarcely attack it, but fused with the alkalies it is readily decomposed, and forms a variety of soluble silica.

In France an analogous siliceous earth occurs, to which is given the name of Randanite, from Randan, in the Puy de Dôme. The rich deposits occur equally in Scotland, near Aberdeen, and in the island of Mull, in Norway, where the product is known under the name of bergmehl (mountain meal), in the State of Virginia, U.S.A., Bermuda, Algeria, in New South Wales, and probably other portions of Australia, and in some other parts of the old and new Continents.

SUGAR BOUNTIES.

The following letter, lately addressed to the *Morning Post*, by a gentleman whose name will be recognised as that of one actively engaged for many years in opposing bounties, and an old correspondent of *The Sugar Cane*, aptly quotes the opinions of eminent economists on this troublesome question:—

SIR,—The following quotations from the writings of some leading English and foreign economists in their condemnation of the bounty system as a mischievous interference with International trade, vindicate the sound policy of the Governor-General of India in Council under the powers conferred by the Indian Tariff Acts in levying countervailing duties on the imports of bounty-aided beet sugar. Had this course been adopted years ago in this country our International sugar trade would have been purified from this Protectionist poison. Bentham says nearly all that can be said of this form of protection:—

> "The natural course of things gives a bounty upon the application of industry to the most advantageous branches—a bounty of which the division will always be made in the most equitable way. If artificial bounties take the same course as the natural they are superfluous; if they take a different course they are injurious. In the case of bounties on exportation the error is not so palpable as in that of bounties on production, but the evil is greater. In both cases the money is equally lost. The difference is in the persons who receive it. What you pay for production is received by your own countrymen; what you pay for exportation is bestowed upon strangers. It is an ingenious scheme for inducing a foreign nation to receive tribute from you without being aware of it, a little like that of the Irishman who passed his light guinea by slipping it between two half-pence."

Adam Smith says:—

> "The effect of bounties can only be to force the trade of a country into a channel much less advantageous than that in which it would naturally run of its own accord."

Bastiat, in his "Harmonies of Political Economy," condemns bounties thus:—

> "This intervention of force in the business of exchanges, whether it succeeds in promoting or in restraining them, cannot fail to occasion both the loss and displacement of labour and capital. On one side, natural interests disappear; on the other, artificial interests are created, and men are forced to follow the

course of these interests. It is thus we see important branches of industry established where they ought not to be. France makes sugar. . . . The effect has been to substitute in Europe sickly and precarious for sound and healthy enterprises, and to open the door to commercial crises, to stoppages, to instability, and, finally to pauperism. . . . She gets painfully produced in the North what is produced with facility in the South, creates precarious classes and branches of industry, substitutes for the gratuitous forces of Nature the onerous fatigues of Labour."

M'Culloch writes of this sugar protection as follows:—

"It began in France during the exclusion of Colonial products in the reign of Napoleon, and received a severe check at the return of peace by the admission of West India sugar at a reasonable duty."

As trade implies International exchange, it follows that the mischiefs produced by bounties are International. "Free Trade," writes Professor Cairnes, "is content to turn natural laws to the best account; it does not seek to transcend them." By every economist who has argued against the fallacies of Protection the policy of Free Trade has been regarded as a means, not an end, that end being the establishment of production and distribution on natural, and not on political or artificial bases, so that the survival of the fittest, as the real security for the consumer, may be secured. Bounties are the badges of inferiority, and depend for their mischievous existence on the policy of *laisser-faire*.—Yours, &c.,

WALLWYN P. B. SHEPHEARD.

East Sheen, June 15.

SEEDLING CANE IN PERNAMBUCO.

We have received the following interesting communication from a correspondent in Brazil (which he characterises as "one of the most backward of sugar growing countries"), and it certainly deserves, in more than one point, the careful attention of those engaged in cane cultivation.

The accounts from other cane growing countries are either deficient, or I have looked through them without fully understanding the results obtained by raising cane crops from seed which the writers have described. From what I have gathered, cane from seed does not appear, as a crop, to have replaced cane from shoots to any extent. In Pernambuco, however, where agriculture as a science is but a

name, planters have made a short cut, disregarding the more cautious, scientific methods of others, and several estates grow the bulk of their crop from seedling cane, that is from stock originally produced in the nurseries from seed.

The result of this comparatively rough and ready mode of selection, discarding the polariscope as well as other methods, though possibly the teeth and palate may have been included among them, is that these bold pioneers are mightily satisfied with the results obtained, and intend to continue, which is as good a "proof of the pudding" as can be wished for.

The first attempts were made in 1890, when I obtained some seed (through the agency of *The Sugar Cane*, if I remember rightly,) and divided it among a few friends. None of it came up, which was not surprising. One of their number was emboldened to continue, and succeeded, inducing others to do the same.

As elsewhere, the varieties produced are many and startling. Some canes, splendidly developed, were shown by a planter at a recent meeting of the Sociedade Auxiliadora d'Agricultura, the local Agricultural Society, which exactly resembled the green ribbon cane called in Pernambuco *Imperial*. The seed from which it was grown came from the dark claret coloured variety with an almost black stripe; called here *Louzier, Purple Cane, Black Cane, &c.* The true name of this variety we have not been able to ascertain. A gentleman who had been many years in Mauritius and spent some time here called it *Port Mackay*.

So far, one result of the cultivation of seedling cane has been freedom from "gumming," the disease which so devastated the *Cayanna*, or *Otaheite* cane, as to induce the importation of the purple and many other varieties from the Botanic Gardens in Rio about twenty years ago. This disease is now beginning to attack the said purple cane, judged hitherto, from its extreme hardiness, to be invulnerable. This seems to indicate that with continued cultivation under certain unfavourable circumstances no variety is disease-proof.

This immunity from "gumming" extends to those varieties of seedling canes derived from *Cayanna* (or *Otaheite*) canes which resemble the parents, as well as those differing in appearance from the parents. Contrary to what has been stated as to the results obtained elsewhere in raising cane from this variety, the bulk of the seedling cane in existence here has been raised from it, and evidently with satisfactory results.

One curious variety grown from *Cayanna* has been named by us *Zigzag*, from the peculiarity of its growth, each succeeding joint, or internode, starting to grow in the contrary direction to the preceding one, the alternate ones being parallel to each other and generally in the same plane.

So far it has not been possible to make any analyses of these canes, or of their juice, but I hope to be able to do so next crop. I can only say at present that two planters have assured me that their yield has increased, and that in other ways the new varieties are preferable to the old.

One statement made by the planter who exhibited the green canes referred to at the commencement of these notes, I give for what it may be worth. He stated that he was always more successful in obtaining seedlings from the arrows of cane that remained over from the previous crop, that is, from fully developed cane.

CENTRIFUGALLING BASKETS.

The "Fontaine" Perforated Sheets.

Improvements in baskets of centrifugals employed in sugar works and refineries by the use of perforated sheets, with elongated conical holes and free spaces, on the "Fontaine System" of the Fontaine Perforating Co., Aix la Chapelle, Germany.

Until recently the filtration obtained by the sieves used in centrifugal baskets, more especially with the metal wire cloths, was always irregular, in consequence of the wires expanding under the weight of the charge. These had the further disadvantage of offering no great resistance, while the repairs being difficult long stoppages in the use of the machines were necessary.

The metal employed for the Fontaine filtering sheets is electrolytically refined copper, and these sheets will unroll themselves quite alone in the basket of the centrifugals, and are simply fastened on the wall of the basket by brass bolts and nuts.

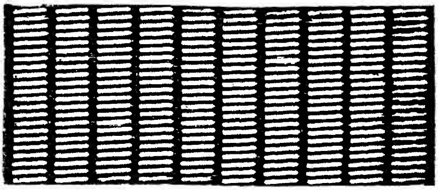
The principal merits of the invention consist in the following:—

The holes are made in two elongated sections, each occupying the half of the thickness of the copper sheets; the first portion, placed inside the basket, is only half as broad as the second part of the hole, placed next to the wall of the basket.

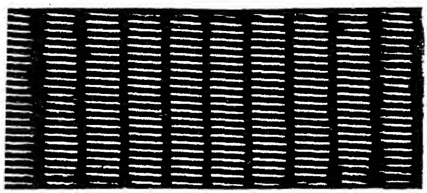
This second part being relatively much broader forms a free space in each hole, thereby avoiding obstruction of the holes caused by an

adhering deposit of sugar, or by the retention of the syrup, the effect of the centrifugal force. In other systems filtering sheets are frequently obstructed in that way. For the reasons given filtration through our perforated sheets is more rapid, and the holes are never obstructed.

The thickness required to allow the construction of the outside free space in the metal gives to the filtering sheets a special and extraordinary solidity.



Width of holes next the wall of the centrifugal basket, No. 21 B.W.G.



Width of holes in the interior of the centrifugal, No. 30 B.W.G.

To sum up, the advantages of the Fontaine sheets with free spaces, called sheets with elongated conical holes, are :—

1. THEY CENTRIFUGAL MORE EASILY, MORE RAPIDLY, AND MORE REGULARLY.

More easily, because the widening of the holes on one side prevents their obstruction, while their disposition permits continuous suction of the syrup.

More rapidly, on account of the great filtering surface of the sheet with elongated conical holes, which is proved by the fact that one square foot of the Fontaine sheet has an open surface of $41''$ $134'''$ square, and one square foot copper sheet with round holes of No. 25 B.W.G. has $21''$ $138'''$ square, while one square foot wire cloth sheet with holes of No. 25 B.W.G. has only $17''$ $40'''$ square on account of the great number of wires.

More regularly, when compared with the wire cloth system, because there the weight of the charge is greater on one side of the basket than on the other, causing also on the one side a widening of the

holes to the detriment of the other side, while filtration with these sheets remains always the same.

2. Larger production.

The holes being smaller hold back a greater quantity of sugar.

Results of Several Trials

made in the sugar works of Penkendorf, Silesia. 100 kilograms of boilings from vacuum-pan gave, after leaving the centrifugal:—

With Sheets. With	Elongated Conical Holes. lbs.	With Round Holes. lbs.
1st day 1st filling up	153¼	146⅔
	155	149
	152	147½
2nd day 2nd filling up	157¾	150¾
	154⅓	149¾
	158⅓	152
3rd day 3rd filling up	151	145½
	152	145½
	154	146½
Average production	154⅕	148⅛

The trial with a wire woven sheet, having holes of No. 25 B.W.G., gave under the same conditions an average produce of 146⅕ lbs.

Therefore the following result:—With the Fontaine sheets with elongated conical holes 6 lbs. more than with sheets having round holes, and 8 lbs. more than with wire woven sheets.

3. Long duration of these sheets.

The conical form of the holes has permitted the manufacture of these sheets from copper of 1 millim. thickness, which has never been obtained before.

4. Facility of fixing, cleaning, and repairs.

Fixing. The copper sheets are made to the exact dimensions of the baskets, and they will unroll themselves automatically in the baskets.

The two ends placed one upon the other are fastened on the wall of the basket with several round headed brass bolts, made especially for this purpose, and with brass nuts to suit.

(More particular instructions for the fixing of the sheets are given if desired.)

Cleaning. The cleaning is best effected in a dry way without employment of warm water, on account of the perfect surface of the copper filtering sheet.

Repairs. In case of accidents, such as occasionally happen to basket filtering sheets, the repairs can be made at once by ordinary solder, without having to displace the filtering sheets.

Supporting Sheets. As a rule a supporting brass sheet, with large open spaces, is placed between the perforated sheet and the basket of the centrifugal, in order to support the perforated sheet.

NOTICE OF BOOK.

Jaarboek voor Suikerfabrikanten op Java, 1899.

We have pleasure in again calling attention to this most useful and thoroughly practical Handbook and Calendar, which, in addition to a most complete list of the Java Factories, contains a mass of useful statistics on everything relating to the cane sugar, and on many points of interest connected with the beet sugar industry also. It is the only book of reference of any value to those who wish to make themselves thoroughly acquainted with the facts relating to the Java sugar industry, and is a model of neatness and perspicuity of detail.

It is published by J. H. de Bussy, Rokin, 60, Amsterdam, and we believe is compiled under the direct supervision of the most competent authority on such subjects in Java.

Correspondence.

The Influence of Temperature on Polarisation.

My dear Mr. Sutton,

I have read with much interest the articles on the polariscope and the influence of temperature on polarization, in your issues of February and May of this year.

You are quite right in saying that I was not the first to call attention to the great influence of changing temperature on the readings of the polariscope. This was first done, I believe, by Professor Andrews of the Boston Institute of Technology in 1888 or '89. In 1891 I was appointed, by the Secretary of the U.S. Treasury Department, the Chairman of a Commission to formulate regulations for the polarization of sugars on which a domestic bounty was to be paid. This Commission adopted the results of researches made by the Office of Weights and Measures of the U. S. Coast and Geodetic Survey, to correct the readings of the polariscope for temperature.

You will see therefore that the suggestions of Professor Harrison, to which you refer, came two or three years after the official action had been taken by the United States Government.

In the paper which I read in Vienna I did not claim any priority in this matter, but only gave the data of my own researches into the effects caused by temperature upon polarizations.

This matter is now attracting considerable attention in all quarters of the world, and I think it is but just to say that the initiative was taken in this country, first by Professor Andrews, second by the Office of Weights and Measures of the U. S. Coast and Geodetic Survey, and third by the U. S. Treasury Department, which adopted, in 1891, the regulations of which I have just spoken. These regulations, practically unchanged, are still in force in this country, and are applied now to the collection of duties on imported sugars. I send you a copy of the last edition of these regulations, prepared by the Commission of which I was Chairman, and of which the other members were Dr. C. A. Crampton, of the Bureau of Internal Revenue, and Mr. A. Braid, of the Office of Weights and Measures of the U. S. Coast and Geodetic Survey.

I trust that the insertion of this letter in your Journal will correct the erroneous impressions which former numbers have produced.

Respectfully,

H. W. Wiley,

Chief, Division of Chemistry.

United States Department of Agriculture,
Division of Chemistry,
Washington, D.C., June 3, 1899.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; 322, High Holborn, London; and 118, New Street, Birmingham.

ENGLISH.

APPLICATIONS.

10079. W. T. Carter, London. *Improvements in turbines to be actuated by steam or other fluid pressure.* 12th May, 1899.

10296. Samuel Lount, Birmingham. *Improvements in radial flow steam turbine engines or motors.* (Complete specification.) 16th May, 1899.

10881. J. W. JOHNSTON, London. (A communication by D. Little, Victoria.) *Improvements in turbines to be driven by steam or other elastic fluid.* 24th May, 1299.

10980. A. L. BILLARDON, London. *Improvements in and relating to turbines.* 25th May, 1899.

11018. L. RIVIÈRE, London. *Improvements in integrator evaporator apparatus for the treatment of liquids, particularly applicable in the manufacture of sugar, soap, fatty substances and the like.* 26th May, 1899.

11124. JAMES MECREDY, London. *Improvements in apparatus for concentrating or drying liquid or semi-liquid substances by evaporation.* 27th May, 1899.

11399. J. MC.NEIL, Govan, Scotland. *Improvements in evaporating apparatus.* 1st June, 1899.

11557. C. WEICHELT, London. *Improvements relating to turbines.* (Complete specification.) 2nd June, 1899.

ABRIDGMENTS.

8232. THOMAS HALEY, of Rockford, Ill., and THEODORE H. KRAFT, of Marshalltown, Iowa., both of United States of America. *Improvements in apparatus for drying sugar, grain, cotton-waste and other substances and materials.* 6th April 1898. This invention relates to improvements in driers for drying seed, sugar or any similar material. It comprises an inclined rotating cylinder, combined with a heating system consisting of suitable tube-chambers placed at each end of said cylinder, a row of tubes arranged around the casing, with a group of tubes arranged within said row of tubes, an axially arranged steam-pipe passing substantially through the cylinder, and nearly through an axially arranged tube, which latter surrounds the major portion of the said steam-pipe.

11511. 1898. EDWARD BEANES, Paddock Wood, Kent. *Improvements in the manufacture of sugar.* 20th May. In this process for the manufacture of sugar, after defecating the juice (either cane or beetroot) it is treated with ozone, or ozonized air, whilst subjected to heat, and, when the juice has reached a density of 30° to 32° Beaumé, it is filtered or skimmed, and afterwards the treatment by ozone or ozonized air continued, until the sugar point is reached.

UNITED STATES.

ABRIDGMENTS.

622708. W. G. PAGE, Calvin, Indian Territory, U.S.A. *Evaporating pans.* April 11th, 1899. This invention has relation to

evaporating pans for sorghum syrup making, and its object is to provide a simple, cheap, and convenient device of this kind. The evaporating pan is combined with a circular plate, which is provided with a solid portion, a perforated strainer, and an opening.

622712. L. Rissmuller, Newark, N.J., U.S.A. *Centrifugal machine.* 11th April, 1899. The objects of the invention are, first, to provide a centrifugal separator with a bowl divided horizontally to form separable sections, and with connections for operating the bowl and separating the sections thereof, whereby the rotary movements of the bowl are used when the sections are not separated for the separation of the lighter ingredients from a mixture treated therein, and also upon the separation of the sections, for the explusion of the remaining bodies; second, to provide a centrifugal separator which may be continuously rotated during the operations of supplying the mixture to the bowl, the separation of the substances, and the expulsion of the remaining ingredients, whereby successive portions of the mixture may be treated without the necessity of stopping the machine, while the number of operating parts is diminished and a great economy in cost of the apparatus and of the treatment of substances is effected.

623105. G. Ranson, France. *Process of decolorising and purifying sugar juice or syrup.* April 11th, 1899. In a prior patent of this invention (Serial No. 640561, 1897) a process is described for decolorising and purifying sugar-syrup by the use of hyposulphurous acid in a nascent state. The special means for producing this acid in this state there described is sulphur dioxide or sulphurous acid in the presence of zinc powder. Now the inventor has discovered that the substitution of tin for zinc in the above-entitled process causes an improved purification and decoloration of sugar juices. This is due to the fact that certain insoluble compounds of tin are formed by the re-action, which assist the purification. The best results are obtained when these compounds are formed in the body of the syrup itself.

623106. G. Ranson, Montmorency, France. *Process of decoloring and purifying sugar juice or syrup.* April 11th, 1899. The process has for its object to clear and render colourless sugar juice or syrup, whether obtainable from the beet or from cane, and, broadly stated, this is effected by oxidising the colouring matter of impurities, then getting rid of the excess of oxygen by a reducing agent, which is preferably used in excess, and then exactly neutralising the excess of the reducing agent by a measured quantity of an oxidising agent. The treatment

thus outlined is carried on by keeping the syrup generally alkaline. A treatment, however, may be used in which the first oxidation step is dispensed with and the syrup is instead rendered acid, then treated with the reducing agent, and finally treated with the oxidising agent. This acid treatment may thus either be considered as a reversal of the alkaline treatment in so far as in it the invention first reduces and then oxidises instead of first oxidising and then reducing, or it may be considered as a treatment embodying merely the last two steps of the alkaline treatment, namely, the reducing and the oxidising steps in order. The apparatus which is used in this process of decoloration and defacation is of the general type.

624510. E. LISTER, Newark, U.S.A. *Bone-black kiln.* 9th May, 1899. This invention relates to that class of retorts adapted to be stationed within a furnace in a series and open at their upper ends to receive the bone or other materials to be acted on, and at their lower ends to allow the products to gravitate automatically into a suitable receptacle below. Its objects are to secure a more even or uniform carbonisation of bone or other material, to reduce the cost of manufacturing bone-black, and to secure other advantages and results.

625031. LUDWIG HIRT, Grevenbroich, Germany. *Crystallising apparatus.* 16th May, 1899. This invention relates to apparatus for crystallising the substance capable of being crystallised contained in the masse-cuite of the sugar-making process and in other solutions. By this invention the stirrers are preferably of such construction, that while they act in the two halves of the cylindrical vessel in opposite directions they thoroughly mix the masse-cuite under treatment, and keep it in constant motion while crystallisation is going on. They will prevent any crystallised matter from settling on the side walls or heads of said vessel. Furthermore, the stirrers may be easily separately removed from the axle and replaced by others. The device for admitting heating or cooling medium into the space of the double casing very much simplifies the connection of such parts with the outer shell of said vessel.

626036. JOSEPH PUTZEYS, Hougaerde, Belgium. *Process of moulding sugar.* May 30th, 1899. This process consists in making a solution of water and finely-pulverized sugar, then mixing a portion of the solution with more coarsely-pulverized sugar, crystallizing the mixture under heat, separating the resultant crystallized product and the residual syrup, mixing the said residual syrup with

more of the first solution to form a second solution, and lastly, repeating the foregoing steps of the process using the second solution in lieu of the first solution to form the mixture with the coarsely-pulverized sugar.

626292. James G. Oxnard and W. Bauer, of New York, N.Y. *Process of manufacturing granulated sugar from beets.* June 6th, 1899. This invention relates to a process of manufacturing standard granulated or white sugar from beets and from the molasses which results from a treatment of the beet juice, whereby substantially all of the sugar contained in the beets is recovered and used for the manufacture of a granulated or white sugar of the recognised standard, without making at any stage of the process an inferior or lower grade of sugar. This invention consists, essentially, in adding to fresh beet-juice, first, molasses (green syrup) and the clairce (wash-syrup) obtained from washing a granulated masse-cuite and the clairce obtained from washing a mixed strike to produce a mixed strike, then purging the masse-cuite and washing the same to white sugar, and then collecting the molasses, which is a final molasses, and the clairce separately, whereby the clairce is returned to a mixed strike, and all the sugar contained in the beet-juice is converted into granulated or white sugar of standard quality, without making at any stage of the process any lower grade of sugar. The invention also consists in taking, first, molasses of a straight strike and adding lime thereto to form a tri-sucrate of lime, then using one portion of this tri-sucrate in defecation of fresh beet-juice, then carbonating, filtering off the carbonate of lime, and adding to this filtered clarified juice the reserved portion of trisucrate of lime and heating the mixture to set part of the lime free by the formation of mono-sucrate and hydrate of lime, then filtering off the separated hydrate of lime, then carbonating the mono-sucrate to remove the remaining lime as a carbonate of lime and filtering off the lime, then concentrating the clarified juice, clarifying and filtering said juice, and finally boiling to grain.

Patentees of Inventions connected with the production, manufacture, and refining of sugar will find *The International Sugar Journal* the best medium for their advertisements.

The International Sugar Journal has a wide circulation among planters and manufacturers in all sugar-producing countries, as well as among refiners, merchants, commission agents, and brokers, interested in the trade, at home and abroad.

IMPORTS AND EXPORTS OF SUGAR (UNITED KINGDOM).

To end of May, 1898 and 1899.

IMPORTS.

Raw Sugars.	Quantities.		Values.	
	1898.	1899.	1898.	1899.
	Cwts.	Cwts.	£	£
Germany	2,702,735	1,934,053	1,198,728	943,071
Holland	112,980	218,561	45,348	99,977
Belgium	339,853	752,602	145,081	362,179
France	1,056,163	757,214	522,121	413,566
Java	60,600	84,862	33,067	48,836
Philippine Islands	165,790	161,149	62,298	73,872
Cuba and Porto Rico	4,500	1,320	2,500	1,000
Peru	563,962	240,412	279,828	131,663
Brazil	207,850	53,675	94,448	27,965
Mauritius	5,970	97,000	2,818	47,138
British East Indies	93,330	138,003	36,861	64,787
British W. Indies, British Guiana, & Brit. Honduras	499,158	546,857	295,603	410,169
Other Countries	288,691	403,525	141,509	222,903
Total Raw Sugars	6,101,582	5,389,233	2,860,210	2,847,126
Refined Sugars.				
Germany	4,433,798	4,936,839	2,668,668	3,039,963
Holland	947,762	921,223	604,496	607,149
Belgium	174,502	111,915	112,161	71,927
France	916,319	964,215	565,617	600,656
United States	5,040	1,610	5,856	2,278
Other Countries	27,932	15,627	15,731	9,273
Total Refined Sugars	6,505,353	6,951,429	3,972,529	4,331,246
Molasses	408,642	563,477	104,331	138,538
Total Imports	13,015,577	12,904,139	6,937,070	7,316,910

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden and Norway	39,402	32,687	22,965	20,503
Denmark	55,247	57,179	27,473	31,656
Holland	44,031	44,270	24,234	26,482
Belgium	6,435	5,764	3,525	3,426
Portugal, Azores, &c.	37,937	36,592	20,370	20,682
Italy	17,367	9,526	9,072	5,435
Other Countries	92,872	96,308	53,073	56,791
	293,291	282,326	160,712	164,975
Foreign & Colonial Sugars.				
Refined and Candy	73,266	62,901	44,785	40,408
Unrefined	231,261	136,094	127,412	80,550
Molasses	127,292	49,233	38,323	15,132
Total Exports	725,110	530,554	371,232	301,065

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1899. Tons.		1898. Tons.
Total Receipts, 1st Jan. to 15th June ..	876,401	..	657,288
Receipts of Refined " " " ..	1,602	..	13,726
Deliveries " " " ..	900,542	..	650,996
Consumption (4 Ports, Exports deducted) since 1st January	706,028	..	583,752
Importers' Stocks (4 Ports) June 14th..	3,279	..	76,008
Total Stocks, June 21st	281,000	..	317,722
Stocks in Cuban Ports, June 21st ..	75,000	..	80,075
	1898.		1897.
Total Consumption for twelve months ..	2,047,344	..	2,071,413

CUBA.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, 1898 AND 1899.

(Tons of 2,240lbs.)	1898. Tons.		1899. Tons.
Exports	180,164	..	181,228
Stocks	86,595	..	84,055
	266,759		265,283
Local Consumption (five months)	20,600	..	16,800
	287,359		282,083
Stocks on the 1st January (old crop)	1,515	..	4,336
Receipts at Ports up to 31st May	285,844	..	277,747

JOAQUIN GUMA.

UNITED KINGDOM.

STATEMENT OF FIVE MONTHS' IMPORTS, EXPORTS, AND CONSUMPTION FOR THREE YEARS.

	1899. Tons.		1898. Tons.		1897. Tons.
Stock, 1st January	76,930	..	90,030	..	139,623
Imports, Raw Sugar, Jan. 1st to May 31st	269,462	..	305,079	..	242,680
" Refined, Jan. 1st to May 31st ..	347,571	..	325,267	..	302,566
" Molasses, Jan. 1st to May 31st..	28,174	..	20,432	..	23,614
	722,137		740,808		708,483
Stock, in 4 chief Ports, May 31st	55,000	..	81,000	..	94,000
	667,137		659,808		614,483
Exports (Foreign, and British Refined) ..	26,528	..	36,255	..	38,043
Apparent Consumption for Five months..	640,609		623,553		576,440

STOCKS OF SUGAR IN EUROPE AT UNEVEN DATES, JUNE 1ST TO 20TH, COMPARED WITH PREVIOUS YEARS.
IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	TOTAL 1899.
65	469	394	294	99	1321

	1898.		1897.		1896.		1895.
Totals	1521	..	1442	..	1523	..	1508

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING 31ST MAY, IN THOUSANDS OF TONS.

Great Britain.	Germany	France.	Austria.	Holland, Belgium, &c.	Total 1898-99.	Total 1897-98.	Total 1896-97.
1669	781	559	360	444	3813	3737	3392

ESTIMATED CROP OF BEETROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE CURRENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1898-99. Tons.	1897-98. Tons.	1896-97. Tons.	1895-96. Tons.
Germany	1,725,000 ..	1,852,857 ..	1,836,536 ..	1,615,111
Austria	1,040,000 ..	831,667 ..	934,007 ..	791,405
France	835,000 ..	821,235 ..	752,081 ..	667,853
Russia	795,000 ..	738,715 ..	714,936 ..	712,096
Belgium........	220,000 ..	265,397 ..	288,009 ..	235,795
Holland........	155,000 ..	125,658 ..	174,206 ..	106,829
Other Countries..	160,000 ..	196,245 ..	202,990 ..	156,340
	4,950,000	4,831,774	4,902,765	4,285,429

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

The course of the market during the month now closing has been irregular. During the first half, the price of beet at one time advanced as far as 11s. 5d., the result of some speculative movement in Paris and a temporary advance in quotations in America. However, as no fresh orders came from the United States and the imports (on account of previous purchases) continued to be heavy there, there was a decline, which was partially recovered on the news of some further moderate orders having been received from the American Continent. The stocks in Hamburg increasing and some holders having realised, a steady decline set in and has continued with but slight recovery, the price for prompt beet being now about 10s. 9d. Values of cane sugar have not been correspondingly affected, nor have refined sorts declined so much as raw beet.

We cannot attribute the present condition of the market to anything but want of confidence. General consumption is certainly increasing and so-called invisible stocks must be growing steadily smaller. We cannot think the present apathetic state can long be maintained at the time of greatest demand by the consumer.

The following quotations are in all cases for prompt delivery :—

			Last Month.
Porto Rico, fair to good Refining	11/6 to 12/6	against	11/6 to 12/9
Cuba Centrifugals, 97°/$_{o}$ polarization....	12/9	,,	12/9
Java, No. 14 to 15 D.S.	13/0	,,	13/0 to 13/3
British West India, fair brown	11/6 to 11/9	,,	11/6 to 12/0
Bahia, low to middling brown	10/6	,,	10/3 to 11/0
,, Nos. 8 and 9..	11/3 to 11/6	,,	11/0 to 11/6
Pernams, regular to superior Americanos.	11/6 to 11/9	,,	11/3 to 11/9
Madras Cane Jaggery	10/0	,,	9/9 to 10/0
Manila Taals	9/3 to 9/6	,,	9/3 to 9/6

French Crystals, No. 3, f.o.b.	12/3	,,	12/3
Russian Crystals, c.i.f..	?	,,	?
German granulated, f.o.b.	12/3	,,	12/6$\frac{3}{4}$
Tate's Cubes..	16/1$\frac{1}{2}$	,,	16/3
Beet, German and Austrian, 88%, f.o.b. ..	10/9$\frac{1}{2}$	,,	11/3

THE

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Advertisements from those desiring employment are inserted FREE OF CHARGE. All Advertisements to be sent *direct*.

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The Board of Trade returns show the following differences between the imports of sugar into the United Kingdom during the first six months of 1898 and 1899 :—

RAW BEET SUGAR.

	1898. Tons.	1899. Tons.	Increase. Tons.	Decrease. Tons.
Germany	156,297	112,145	—	44,152
Holland	6,950	12,396	5,446	—
Belgium	25,743	41,560	15,817	—
France	61,543	44,908	—	16,635
	250,533	211,009	—	39,524

RAW CANE SUGAR.

	1898. Tons.	1899. Tons.	Increase. Tons.	Decrease. Tons.
Java	3,035	4,638	1,603	—
Philippines	13,140	8,057	—	5,083
Cuba, &c.,	259	66	—	193
Peru	33,107	12,309	—	20,798
Brazil	14,705	2,741	—	11,964
Mauritius	578	4,850	4,272	—
British E. Indies	7,636	14,722	7,086	—
British W. Indies, &c.	30,739	31,824	1,085	—
Other Countries	18,071	25,720	7,549	—
	121,270	104,927	—	16,343
Total of raw imports, including Molasses	397,290	351,602	—	45,687

Perhaps the most noteworthy feature in the figures just given is the decrease in the imports from Peru and Brazil. Quite the contrary was the case in the comparison of the first six months of 1897 and 1898. Henceforth we may expect the imports from Brazil to be very moderate. The increase in imports of refined sugar is 14,265 tons; that for the six months of 1898, as compared with 1897, was 26,025 tons. The quantity from Belgium is 3,527 tons less than in 1897, that from Germany 17,439 tons more. See table on page 445.

Our February and May numbers contained articles relating to polariscopes and their uses in tropical countries. In the present number will be found further interesting matter relating to these questions.

Messrs. Blyth Bros. and Co., of Mauritius, give shipments of sugar from 1st August, 1898, to 24th June, 1899, as 180,680 tons against 113,485 tons during the corresponding period of the preceding season. The last telegram reports that the plague continues unabated, with a mortality of about 26 per week. Prospects for the coming crop are good.

Exports from British Guiana from 1st January to 4th July:—Sugar, 30,355 tons; rum, 5,872 puns.; molasses, 3,224 casks; cocoa, 114,674 lbs.; against 43,428 tons, 10,614 puns., 1,061 casks, and 41,435 lbs., respectively for the like period last year.

The *Antigua Standard* gives a report of a discussion on the question of the establishment of a central factory, which took place in the room of the Agricultural Society on the 6th June, at which Mr. Robert Harvey, who had been instructed by the Colonial Secretary to submit an opinion on the subject, was present. The matter was thoroughly gone into, and there seems no doubt that the report which Mr. Harvey has now forwarded to Mr. Chamberlain will recommend the erection of one or more central factories, as he definitely stated that he did not see any difficulty excepting the want of money, and that difficulty was for the Government to deal with. He also remarked that he did not think, from what he had learned, that planters would be at all unable to make a living out of canes at 12s. per ton. This is, of course, contrary to the views strongly held and expressed by Barbados planters.

The *Journal des Fabricants de Sucre* says that the *Antilles* states the yield obtained in the factories at Martinique, in spite of improved machinery, does not exceed, on the average, 7·50 to 8 per cent. (at most) of the weight of canes, while nearly all the chemists accustomed to sugar analyses put the extractable sugar in the cane at 14·8 per cent.

The net amount of the bounty paid by Germany on the export of raw sugar testing at least 90 per cent., as ascertained and determined under the provisions of section 5 of the Act of July 24th, 1897, is hereby declared at 2·40 marks per 100 kilograms for the assessment of additional duty under the said law.

The rate of marks 2·40 per 100 kilos is equal to ·250c. per lb. The former rate of raw sugar was marks 2·50, equal to ·270c. per lb. The rate on Granulated remains unchanged at marks 3·55 per 100 kilos, equal to ·383c. per lb.—*Willett and Gray.*

Arrangements are being made for the importation of 1,000 Italians into the Hawaiian Islands, and some hundreds of Portuguese (probably from the Azores) have already been introduced as workers on the plantations, The old Hawaiian law permitting the engagement of Japanese contract labourers still remains in force, though it will probably soon be annulled by the United States Government.

The half-yearly meeting of the Colonial Sugar Refining Company was held in Sydney on the 28th April, when a very satisfactory balance sheet was presented and adopted. It was shown that the profits made during that period, after providing for interest and all other charges, amounted to £85,580 17s. 7d., to which sum had to be added the balance at profit and loss account on 30th September, 1898 (£90,250 1s. 5d.), leaving available the sum of £175,830 19s. A dividend of 10 per cent. per annum was declared, leaving to credit of profit and loss account, £90,730 19s. It was stated that the output of sugar from the company's mills during the season of 1898 had been very large, and had been produced at a cost somewhat below that of previous years.

Chile has granted a bounty of two centavos per kilo. on beet sugar produced in the country, to last for six years. The sums to be devoted to the purpose are: for 1899, about £5,000; 1900, about £10,000; 1901, about £15,000; and for the three following years, about £20,000 each, reckoning the peso at its full inland value of about 4s. Further,

the railway rates for beets, sugar, and molasses are not to be raised during the next ten years.

In Michigan (U.S.A.) a state bounty of one cent. per lb. was granted in 1897, for which, of course, there had to be an appropriation in the annual budget. The amount of 200,000 dollars was voted for the purpose, but up to now none of this appears to have been paid by the authorities. This bill was amended in the session now closed, the bounty being reduced to half a cent., but the new bill was vetoed by the Governor on the ground that there was danger of the State being called on to pay any amount without limit, and so things remain in statu quo, but it is poor encouragement to proprietors of beet factories.

The Maffra Beet Sugar Company of Victoria (Australia) is apparently in a perilous condition. The shareholders have contributed £31,000, the Government £64,000, but, according to the *Queenslander*, "the institution is in such dire distress that unless further State assistance is forthcoming, or the farmers show their interest in a more practical manner than they have hitherto seen fit to do, the collapse of the company is almost inevitable." The farmers cannot be got to grow sufficient beets, as the last results were so bad.

The beet sugar factory which was started two years ago by Belgian capitalists, is also not doing well. Its output is not more than one-third the quantity which must be annually produced before any profit can be shown.

When we take into account the last news from Queensland, to the effect that sugar producers are asking for a heavy duty on all sugar not of Australian production, and for a high countervailing duty on sugars which have received a bounty, further the fact that the Moreton Central Mill (Queensland), has to be taken over by the Government, "the company not being in a position to carry on, having expended too much on tramways," it would indeed seem as though the sugar industry everywhere were a tender plant that can only be grown under the hothouse protection of artificial government aid. The *Queenslander* adds, "This is the first of our State-aided sugar mill failures, and it would be idle to endeavour to conceal its importance to the country."

JAMAICA.

THE SUGAR INDUSTRY.

Mr. Francis Watts, whose appointment as Island Chemist for Jamaica we announced about eighteen months ago, has now taken up the duties of chemist-in-charge at Antigua and St. Kitts-Nevis. During his stay in Jamaica he was very actively employed in investigating the sugar industry there in all its bearings for which his previous experience had well qualified him, and it was suggested to him that it might be of service if he placed on record some ideas which had occurred to him during the course of his enquiries and observations relating to the subject in question. This he has done in the following document which we take from a letter in the Jamaica *Gleaner* of the 12th July, but it is not stated to whom the letter was addressed:—

"The advantages of the sugar industry to a colony are such that it appears to be highly desirable that efforts should be made to preserve this industry to Jamaica. It is an industry with which a large section of all grades of the community is familiar, both as regards the production and also the marketing of sugar; it affords regular employment to a large number of people, and it is an industry for which certain districts of Jamaica are eminently suited. Should the industry once pass away from the colony its re-introduction would be a matter of extreme difficulty.

"At the present time the greater part of the sugar produced in Jamaica is manufactured by the old and wasteful muscovado process in small sugar works, most of which are imperfectly equipped. Although at the moment of writing the price of sugar is higher than it has been for some years, the views of those well calculated to form reliable opinions, are, that the price of sugar in future years will not be substantially higher than it has been during the past decade. At these prices, and with the system and appliances in vogue in Jamaica, sugar-growing during this period has not been an attractive or remunerative business. It is highly desirable therefore, that means should be found to place the industry on a better footing, if possible, and there is good reason to believe that this may be accomplished.

"The losses entailed by the muscovado system of sugar making may be briefly indicated thus:—

"Loss from imperfect crushing.

"Loss due to the imperfect recovery or extraction of sugar from the juice.

"Loss due to the production of low grade sugar fit only for the refinery.

"These losses are those inseparable from the manufacture of sugar in small works; they may be avoided by substituting for these small works central factories sufficiently large to permit of the introduction of machinery of the best and most economical type.

"Taking the losses just referred to, there are very few instances in which the actual crushing power of the Jamaica mills is accurately known. (Trials made on small lots of cane, one ton for instance, I take to be of little value.) From what I can gather I believe the crushing power varies greatly. I infer, however, that the mills in all probability do not give more than 60 per cent. of the weight of the canes in the form of juice, whereas by the mills of a central factory, where the canes would be passed through three sets of mills in succession, the yield should be 75 per cent. or over, so that if my assumption is correct—and the planters should ascertain this for themselves—15 parts of the juice remain in the canes for every 60 parts expressed, or 25 per cent.

"The amount of sugar extracted from the juice for every 100 raw parts of sugar therein has never been ascertained over a long period, nor for several places, in Jamaica. In Antigua I ascertained that upwards of 80 pounds of muscovado sugar were extracted for every 100 pounds of raw sugar in the juice, often this figure was exceeded; there, however, the conditions were dissimilar from those in Jamaica, for in Antigua no rum was made and therefore efforts were directed towards obtaining as much sugar and as little molasses as possible. In Jamaica where rum is made, there have been no special efforts to reduce the quantity of molasses, and, from a very limited number of observations, I came to the conclusion that the amount of sugar extracted was very low, probably considerably under 70 pounds from every 100 of raw sugar in the juice. Now that rum is bringing very low prices it is for the planters themselves to ascertain how far it proves remunerative to allow sugar to pass away as molasses to be converted into alcohol.

"With modern machinery it is possible to recover from 83 to 88 pounds of marketable sugar for every 100 pounds of raw sugar in the juice; the actual quantity will vary with the quality of the sugar made and with the quality of the juice.

"In muscovado works it is difficult to control the quality and quantity of the sugar to be made, and low grade sugar alone can be made; this is only fit for the refiner and consequently always brings lower prices than sugar capable of entering directly into consumption. In factories fitted with modern appliances it is possible to produce sugar of any required character from dark refiners' sugar to white and yellow grocery sugar according to the market demands for the various grades. The quantity of sugar too is controlled; all the available sugar is extracted from the molasses and a rigid control is kept showing any losses which may occur. All these points lead to greater efficiency and economy in working.

"I have thus indicated in the briefest possible manner the chief defects of the muscovado system and how these are overcome by manufacturing sugar in large factories. Recognizing these points, and many others, planters have from time to time made efforts to secure factories capable of reducing the losses now experienced. They have always met with the difficulty that such factories are large and costly affairs which must involve the combination and co-operation of several estates in order to procure their advantages. The difficulties of obtaining capital and combination have led to the abandonment of many schemes. Efforts are now being renewed to effect the necessary combination and to procure the necessary capital for more than one factory in Jamaica.

"To secure the advantages afforded by the best machinery it appears to be necessary to have factories capable of making not less than 3,000 or 4,000 tons of sugar and up to 10,000 or over in each season. There has been much argument as to the most economical size. Doubtless, if the factory were the only point to be considered, the larger the factory the greater the economy in working, but in most instances the capabilities of the district in which the factory is to be placed, the quantity of cane available, and the conflicting business interests of estate owners, all have to be taken into account in preparing plans for any central factory scheme. From want of correct appreciation of these local points there is often a tendency to suggest factories which may be found too large for the district in question. It is important to ascertain what cane supply can be actually guaranteed or relied upon, so as to design a factory capable of dealing with these canes and at the same time capable of so having its capacity increased that any reasonable development of supply may be dealt with without incurring great additional expense.

The additions to the factory's capacity need not be made unless there is good ground for thinking that they will prove remunerative, whereas if a factory too large in size is erected the charges for interest and maintenance may prove fatal to profitable working.

"How the capital is to be procured and the amount to be provided are themes for much discussion. If the cane growers who can associate themselves together are able to provide the required capital they will be able to procure a factory for the minimum cost and will be able to work with a minimum amount of capital. Unfortunately this condition is seldom met with in the West Indies. When capital has to be procured from outside it will always be found in practice that rather more will be wanted than in the case just mentioned, and the cost of the factory itself will also be somewhat greater.

"If central factories are erected by outside capital, it is of the first importance to any colony that the basis of trading should be a co-operative one. If this is not the case a condition of affairs may arise whereby practically all the profits of the industry are sent away from the colony, and the final stage may be more disastrous than that now existing. Matters should be so arranged that those owning the land and growing canes participate in any advantages arising from the factory. Most modern schemes contain some provision whereby this is secured, this is usually made by providing that a portion of the cost of the factory shall be paid out of profits, and that ultimately the factory shall become the joint property of the capitalists and the cane-growers. It will be seen that there is much scope for sound judgment in adjusting the initial cost of the factory, part of which has to be paid off out of profits, and of determining what proportions of the factory and its business shall ultimately belong to the capitalists and to the cane-growers respectively.

"Considerable difficulty has been experienced in ascertaining what price should be paid for canes. In Queensland and in Egypt the price is about 13s. to 14s. per ton. Where the cane-growers are ultimately to become the owners or part owners of the factory this difficulty is minimised, for the lower the price paid for canes the larger will be the profit of the factory, and the sooner will a portion of the cost be paid off, so that the cane-growers will then own a large portion of the factory and directly share the profits. In most of the schemes recently put forward in the West Indies it has been proposed to pay about 10s. to 11s. per ton for canes delivered at the mill.

"Several schemes have been recently put forward whereby the

investment of outside capital has been invited for the improvement of the conditions of sugar manufacture; in discussing them it is well that attention should be directed to those points which I have here only indicated in a very brief manner.

"In Queensland considerable impetus has been given to the sugar industry by Government aid, whereby the Government guarantees the interest upon money invested in the erection of sugar works under certain well-defined regulations.

"Thus, Queensland Sugar-works Guarantee Act was passed in 1893, and has thus been in operation for a few years; it appears to be most carefully compiled and affords the Government ample security. In considering the desirability of introducing such a method of working into Jamaica, perhaps the first point which is worth noting is that its successful operation should be more easily secured in a colony like Jamaica, where sugar producing now exists as an industry of considerable magnitude merely waiting for improvements in methods of manufacture, the canes being already in existence, than under the Queensland conditions, where the sugar industry was a comparatively new one.

"There is little doubt that the cost of erecting and working factories would be less with some such form of government aid as that provided in Queensland, than will be the case if outside capital alone is found for the undertaking.

"Where sugar can be grown on lands irrigated at small expense, the sugar industry ceases to be a precarious one, and should prove highly remunerative. This can be accomplished in some districts of Jamaica, and here there ought to exist a thriving industry affording stability to the welfare of the colony. In addition to the districts capable of irrigation there are many other places well suited for sugar growing where central sugar factories could be erected to the advantage alike of the sugar-grower and of the colony, if satisfactory means of providing capital can be found and an equitable basis of trading, as between the capitalists and cane-growers, can be secured. In all this, I see no difficulties greater than those which have to be overcome in most commercial undertakings."

Experiments lately made with ozone, by Aulard (the well-known French sugar chemist), did not show any remarkable advantage, at any rate it was found far inferior to the old bone-black (char) as clarifier and purifier. He intends to report later on with regard to a suggested modification of the bone-black process, using larger quantities of char, which he thinks will give still better results.

A NEW ADJUSTABLE POLARIZATION APPARATUS, WITH THE SCALE ON THE QUARTZ-WEDGE.

By Dr. G. Bruhns, Cologne.

The forms of apparatus for polarization hitherto known are in some cases excellent as regards exactitude of the readings, but are subject in the course of time to important changes, due especially to the influence of the temperature, but partly also to the moisture of the atmosphere, which compel the constant use of controlling agents such as quartz plates of known rotatory power, solutions of chemically pure cane sugar of a known strength, and so on. For these reasons, the employment of the apparatus becomes more complicated and less certain, so that hitherto an adjustment of the polarisating apparatus, which are of great commercial importance, was not supposed possible.

Ths cause of this variability is to be found in changes taking place, independently one of another, in the individual parts of the apparatus and according to experience chiefly to the variability of the scales and their relative displacement as respects the accompanying quartz-wedge due to the influences above mentioned.

These disadvantages can be efficiently remedied by engraving or etching the scale on the quartz-wedge itself. Any varying displacement of the wedge and the scale is thereby rendered impossible, as the longitudinal expansion of both must naturally be exactly the same. As the length of the scale depends solely on the angle of the quartz, which may be practically regarded as completely invariable, a single comparison of the wedge with the scale etched on it, with the assistance of scientifically exact instruments, is sufficient to establish once for all any invariable errors of the scale (if such occur) by a correction-table, which is all that is necessary for the adjustment of the wedge. For the practical use of the apparatus provided with such a wedge, only the correct position of the *nonius*, etched most suitably upon the short opposing wedge, has to be ascertained, which is easily done, as with an apparatus not in use, the zero point of the *nonius* must coincide with the zero point of the scale. As soon as the *nonius* is properly fixed the true value of any other portion of the scale can be ascertained with the greatest accuracy by means of the correction-table. The controlling quartz-plates, the titrated sugar solutions, or the second pair of quartz-wedges frequently used hitherto—the so-called double-wedge compensation—which by the way, introduces by its special scale, &c., just as many new sources of error into the

apparatus as the apparatus with a single pair of wedges already contains, are no longer required. By the omission of the second pair of wedges the light in the quartz-scale apparatus becomes much stronger, as it contains four reflecting surfaces less.

A further advantage of this apparatus can be obtained by using the transparency of the scale and of the nonius for lighting both by the polarization lamp in the same way as the sugar solution to be examined, thus doing away with a special lamp or other arrangement for lighting the scale. (The paper is illustrated by sketches, showing the construction of the apparatus.) One figure shows (the front cover of the apparatus being removed) the quartz wedge in its frame with the indication of the scale, which should pass through the centre of the field of vision; because when making a polarization the telescope of the apparatus is fixed upon the section of the half shadow nicol, which is about 30 c.m. distant from the plane of the scale. The scale is therefore invisible for the time and does not disturb the fixing.

To take a reading of the scale the magnifying glass, which has to be fixed in the plane of the scale instead of the telescope, is inserted by a short rotation of the revolving arrangement. As with the half-shadow apparatus a darkening of the scale takes place on reaching the fixing point, an arrangement is combined with the axis of the revolving part by which, together with the magnifying glass, an illuminating quartz-plate is automatically inserted between the analyser and the quartz-wedge. This plate prevents the darkening by destroying the optical equilibrium, but without displacing the scale. The scale may now be easily read. A special advantage of this construction, not yet mentioned, is that on polarizing coloured liquids, the illumination of the scale is weakened owing to the colour of the solution, and thus without preventing the finest reading of the scale a saving of the eyes is possible in the case of frequently changing polarizations and scale readings, and a much quicker working may be attained than by the reading of a scale illuminated with a glaring light. As the wedge cannot be moved from the scale there is no need for it to be cemented in its frame. The disadvantageous tension or pressure due to cementing material, which may lead to an alteration of rotatory power of the wedge, can be easily and completely avoided.

To prevent a further source of alteration of the rotatory power of the wedge, viz., rapid changes of temperature, the wedge with the counter-wedge, and the quartz-plate rotating in the opposite direction,

are embedded in a well-closed box, whice is either lined inside or covered outside with a bad conductor of heat. Landolt, in his work "Das Optische Drehungs-Vermögen, etc.," second edition, p. 345, has already pointed out the necessity of such an arrangement for protection against temperature.

A thermometer placed as close as possible to the long wedge serves for reading the temperature. For very exact working the temperature must always be taken into consideration, and the adjustment has to be effected at different temperatures. At the same time the casing affording protection from heat serves also to protect the wedges from dust, moisture, etc., as well as to render impossible any change of the optical parts of the officially adjusted apparatus by unskilled hands.

The front screws of the box may be secured by a cord and leaden seal at the place of adjustment. On the non-officially adjusted apparatus the protecting box is opened by an ingenious contrivance invented by C. Reichart, of Vienna, which allows the nonius to be displaced by a special key and the quartz-wedge to be taken out at the side.

Finally, to prevent errors in polarization caused by incorrect or varying positions of the lamp, the latter is arranged in such manner on a three-cornered rail that it can only be fixed or moved exactly in the optical axis of the instrument. It can also be obtained fixed to the stand. The stand is purposely very heavy so as to ensure greater stability of the whole apparatus.

At a meeting of the Association of Deutscher Zuckertechniker, held at Stettin, on the 22nd June, Dr. Bruhns delivered an address on his invention, and in the discussion which ensued, it was stated that the Imperial Physico-technical Institution considered that with the practical media at present available it was not possible to obtain a constant source of light, and as the perfect regularity of polarisation depended on the invariability of the light, the possibility of accurate adjustment became a question. Dr. Bruhns replied that in using an adjusted apparatus of course only that kind of light for which it was adjusted must be employed, and so constant results might be obtained, as had been shown by numerous practical experiments.

POLARISCOPES.

Influence of Temperature on the Indications of the Saccharimeter.

In a preceding number (pp. 271–274) we gave a translation of articles on the above subject which had appeared in the *Archief v. d. Java-Suikerindustrie.* No. 7 of this periodical contains a reply by Dr. Nanninga to the objections and remarks urged by Dr. Winter, which seems necessary for a proper comprehension of the questions at issue, and we therefore supply a translation as follows :—

"As one of the reasons for a too low polarisation being given I indicated the varying specific rotation power of the quartz-wedge, which Dr. Winter thinks may be disregarded in view of what he has read in the work of Dr. Landolt already formerly mentioned. On page 336 of that work the adjustment of the saccharimeter is spoken of and in that connection the method with an adjusted quartz-plate is preferred to the use of a normal sugar solution, because the latter method possesses the disadvantage of requiring always to be applied at one and the same temperature. The passage runs : 'The normal quartz-plate, on the other hand, remains always available and correct, and its rotation power in the saccharimeter is independent of the temperature (so long as care is only taken that the wedge-compensation and the normal quartz-plate are of equal temperature),* because the co-efficient of temperature for positive and negative quartz-plates is the same.' From this Dr. Winter thinks he ought to conclude that the increase of the specific rotation power of the quartz-wedge on the polarisation of a sugar solution even at a temperature considerably above the normal one has no influence, because the wedge is in this case verified with quartz plates the rotation of which is determined at European temperature. In so doing, Dr. Winter overlooks the fact that in the chapter quoted *the verification of a saccharimeter* for use in Europe is alone spoken of, but not *the polarisation of a sugar solution at a higher temperature.*

"I will make it clear by an example, that in the latter case the temperature has a considerable influence. Let us assume that the normal quartz-plate indicates 100·0° V., and is adjusted at 15° C., then it will, when placed in a saccharimeter, of which the quartz-wedge has also the temperature of 15° C., do away with exactly the equality of 100·0° V. of the field of view, provided that the saccharimeter is

*The passage in parentheses is not given by Dr. Winter.

accurate. Now if both quartz-plate and wedge are brought up to 30° C., without the micrometer-screw (to which the scale and the wedge are fastened) being turned, then a similar equality of the field of view will also be observed after the heat is raised. The specific rotation power of the two is indeed altered, but the alteration is equally great in both cases. The quartz-plate now no longer rotates 100·0° but 100·23 V.* and so the 100 scale divisions of the saccharimeter no longer represent 100·0° but 100·23° V., so that now each division is equivalent to somewhat more than 1° V. If we now again reduce the temperature of the quartz-wedge to 15°, and bring into the saccharimeter, in place of the quartz-plate, a normal sugar solution of 15°, the divisions of the scale will now once more represent exactly 1° V., while the sugar solution exactly rotates 100·0° V., and so when the saccharimeter indicates 100·0° V. the fields of view are alike.

Now, if we make a sugar solution that is normal at 30°, and, consequently, rotates exactly 100·0° V.,† and polarise this, while the wedge still remains at 15°, then we shall again find at 100·0° V. an equality of the fields of view. But if now we warm the wedge of the saccharimeter to 30°, then the fields of view at 100·0° of the scale are no longer alike. As above remarked, the 100 parts of the scale no longer represent 100°, but 100·23° V.; the sugar solution, however, really rotates only 100·0 V., so that the scale must now indicate less than 100·0°, viz., $100 \times \frac{100}{100{\cdot}23} = 99{\cdot}78°$, in order to obtain an equivalence of the fields of view.

Thus, although our saccharimeter is corrected by a quartz-plate, the rotation of which is determined at the normal European temperature, we find at the increased temperature of 30° C. for our normal sugar solution the considerable deficiency of 0·22° V.

Dr. Winter states as the average temperature for Java 27·5° C., but this is certainly below that of the laboratories during the sugar campaign, which will undoubtedly not be much below 30° C.

The temperature which is taken as normal in drawing up the tables, can be seen by any interested person, merely by turning over the leaves of his book, hence we will not waste any words on this point.

Dr. Winter thinks that copper tubes are to be preferred to glass; this, however, does not make a difference of quite 0·01° V. per 10° C.,

*The increase of the specific rotation power of the quartz-wedge at 100° always amounts to 0·15 V. per 10° increase of temperature, hence for 15°, 0·225° V.

† In this case we shall, for convenience sake, disregard the effect of the reduced specific rotatory power of the sugar solution at the higher temperature.

so that notwithstanding the animadversions of Dr. Winter, I think I may abide by my assertion that in consequence of the influence of temperature on the indication of the saccharimeter for a muscovado of 96° pol., a minus was found of about half a degree of polarisation.

Dr. W. further says that the conditions of sale are based on polarisation by the method of examination which is in use, hence without any correction for temperature, and is of opinion that *for this reason* the defect in the method already spoken of may be neglected. This may be correct so long as the conditions at present established remain in force.

THE ALCOHOLIC FERMENTS OF VENEZUELA.

By M. E. Delafond.

(Bulletin de l'Association des Chimistes de Sucrerie et de Distillerie.)

The alcoholic ferments of Venezuela are much smaller than the kinds known in Europe; their shape approaches the octagonal, especially in the case of the protoplasma, and they require temperatures of at least 30° C. in order to develop and propagate themselves under good conditions, otherwise the fermentations proceed with difficulty and very slowly, the attenuations almost never reaching zero, and vicious and secondary fermentations easily gain the upper hand, while at 36° C., the temperature which best suits them, the fermentations take place very rapidly and under good conditions, with attenuation to zero.

The alcoholic ferment bears very strong doses of acidity, as expressed in H_2SO_4; the European ferments would become paralysed in an acid medium in which that of Venezuela finds itself quite at home. Reproduction of this alcoholic yeast takes place between 30° and 35° C.

At the *Hacienda* Juan Diaz (near Macuto, La Guaira), the proprietor Sr. Manuel Hernaiz) for whom I have just set up and put in working a cane sugar factory for the direct production of white sugar, requested me to examine and follow the workings of the fermentations of syrups, the attenuations of which were found to be 4 Bé., and I now give the results obtained.

The fermenting chamber and the vats had not been kept quite clean, the chamber was kept closed, and I had this looked to. The temperature of the fermenting liquids varied between 33° and 35°. At the outset I condemned this high temperature, saying what every

one in Europe says, that it is dangerous to go beyond the temperature of 30°, because beyond that no propagation of the yeast takes place. But what is true in Europe is not so here. After acidification of the juice, I started a vat with the juice itself. The cane was somewhat damaged, the unsound portions, examined with a microscope, showed the acetic ferment to be present in considerable quantity. I set the juice in fermentation at 8° Baumé, with a temperature of 30° C. Forty-eight hours later the vats marked zero in the areometer, with a temperature of 38° C. During the progress of the fermentation, a fairly large quantity of yeast formed a light cap which was continually being renewed, and at the bottom of the vats a layer of from six to seven centimetres thick is deposited. The microscope shows that these substances are the cells of alcoholic yeasts. The capacity of the vats is 2,000 litres.

As the fermentation is most active between 33° and 36° C., I conclude that in Venezuela the ferments do not suffer from the high temperature; and this phenomenon must certainly be connected with the question of acclimatisation.

It is, however, beyond doubt that the yield in alcohol was doubled by this method of working, viz., by cleanliness, by the preparation of the vats beforehand, acidification, &c., together with fermentations up to 38° C., without employing any other ferment than that contained in the juice; for that matter, in Venezuela there is no possibility of obtaining any other.

The fermentations of juice and of molasses in the other distilleries of the country, are exactly the same as those formerly obtained by Sr. Manuel Hernaiz.

The yield in alcohol is 7·9 per cent., calculated in pure alcohol per 100 litres of juice at 8° Baumé.

Of all European countries, Spain would seem to be the one that best understands "how not to do it." Just when she has lost the great sugar-producing colonies, and the inland production requires all the encouragement possible, it has been decided that machinery for sugar manufacture shall not pay, as hitherto, the lower tax of agricultural machinery, but must be subjected to the higher rate of ordinary machinery. Further, it is proposed to put a customs duty of 100 pesetas per 100 kilos. on foreign sugar, and 50 pesetas on inland production.

MAURITIUS.

Report of the Station Agronomique for 1897.

In the *Sugar Cane* for November last year we gave a translation of a small portion of this interesting report, intending to return to the matter as soon as time and opportunity should allow. The arrangements connected with the change made in our periodical caused the report to be overlooked for a time, but, although somewhat late, we think the experience and results obtained by M. Bonâme, and the deductions therefrom, should be put on record. We are indebted to the English version, made under the supervision of Mr. F. Nash, at that time President of the Chamber of Agriculture, for the following extracts.

The seedlings grown at Mon Plaisir (Pamplemousses) were reaped this year. Planted in November, 1896, and reaped in December, 1897, for distribution among those who wanted to get the new varieties, they were consequently 13 months old. Owing to the drought which prevailed during the whole period of their growth, they had to be irrigated with whatever little water could be secured in order to keep them up. The lie of the field not allowing of a regular irrigation, it happened that certain patches were less watered than others, so that the crop grew irregularly. Nevertheless, it could be ascertained that generally all the varieties which had already yielded good results in the experimental field at Réduit gave equally good results at Pamplemousses. The different kinds could not be weighed separately to allow the yield to be calculated, because as they were offered for sale with the top adherent to the stalk the weighing operations would certainly have injured the buds, which by reason of the rains that fell a fortnight before were already greatly developed. We tried, however, to calculate the yield of the different varieties in several ways, which are too approximate to allow of their being mentioned here. The yield was not such as might have been obtained under normal conditions, but the growth of a great many of these seedlings indicates that although planted very late they may still give very satisfactory returns at the crop, and that they are therefore of comparatively early growth.

These canes were offered for sale to the public at the rate of 10 canes for one rupee, and 230 such lots have been sold. The remainder was sent to the mill. Certain kinds were specially in demand, others

have not perhaps obtained the success that they deserve. Thus, as we shall refer to further on, Nos. 33 and 65 were chiefly in demand, but as we do not possess these two varieties in larger number than others, it has not been found possible to meet all the applications.

These canes are growing at present as first ratoons; they have not yet been matured, and the results which will be recorded this year will be more normal. We therefore strongly advise those planters who do not cultivate the new varieties yet to inspect them before they are reaped.

Seedling canes attract attention at the present moment, great importance being now attached to them by the public, which was far from being the case last year. To bring about that change of mind it was enough to witness on the one hand the very increasingly poor results yielded by the old Lousier variety in certain localities, and on the other the successful results achieved by some plantations of the new varieties. Little attention was paid last year to the subject, but now everybody wishes to have cuttings from seedling canes, and from absolute indifference has passed to immoderate infatuation. Seedlings it is true have given very fair results in certain respects, but as they have not been long grown, and are consequently little known, it would not perhaps be safe to extend the cultivation of a single variety and neglect all the others; inasmuch as there are some which deserve to be planted on a more or less extensive scale, and the more numerous the trial plots, the sooner the real value of the different canes will be known.

To avoid deception on the subject of those different varieties raised from seed, and whose merits are uncertain, it has been said that it might perhaps have been better only to distribute them and make them known after a few years' trial, when their superiority would be established in an unquestionable way. This course of action may have its *raison d'être* in countries where only a single variety of cane is grown, but in Mauritius, where a large number of varieties already exist on every sugar estate, and where every planter has a nursery more or less extensive, where he can study and propagate all the new varieties he can get, it is, we submit, more practical to propagate them as soon as it has been ascertained that they are not inferior to old varieties. Everyone would thus be enabled to study them more closely, and to make a definite selection with special reference to his own locality and the particular circumstances of his mode of cultivation.

The large number of new varieties raised renders their complete study a long and difficult task. When only one variety is to be propagated the work is easy enough, as it consists in planting each node where the young buds have reached a sufficient growth; but when the properties of that cane have to be studied, it must be allowed to grow to complete maturity in order to ascertain its mode of growth, percentage of sucrose, &c., and as, in order to be sure of the results obtained, the planting must be renewed under different conditions, the work will last for several years, which might be lessened if the experiment were repeated at the same time on different estates.

There now exist many new varieties which can be grown without any probable failure, and that number will increase year after year, as sowings have been started at different places and have well succeeded. Sowings are now facilitated because seedlings bear seeds which possess a germinative power more active than seeds obtained from old varieties. and there is great chance of success if the seeds are collected in certain districts where their fecundation and maturation are apparently effected under more normal conditions than in others. The number of seedlings obtained would become still more considerable if it could be ascertained that the panicles which are collected are fertile, so that large quantities could be gathered and the unfertile ones eliminated; but this proof would be difficult to obtain, and hardly practical.

One is therefore obliged to gather a large quantity of flowering heads from different canes, and to test the germinative power of their seeds by direct sowing. After eight or ten days their respective qualities are known; but then it is too late to have a new crop made from the canes which have given these satisfactory results, as the seeds have been scattered by the winds, which at that time of the year are usually strong. When the seeds are fertile, we have merely to collect the panicles when the spikelets begin to fall off spontaneously, and it is not necessary to envelop them with gauze to retain seeds which might drop; we might do as well without this precaution, which of course is useless if the panicles contain no fertile seeds. The ground must have been prepared beforehand and the sowing made as early as possible, as seeds rapidly lose their vitality, and after a month's time they germinate less actively, if at all. Afterwards the seeds must be thinly covered over with fine soil, and frequently watered in order that the soil should never dry up com-

pletely; it is also necessary, in order to preserve moisture, to protect the seed-bed against sunrays, especially during the hot hours of the day, until the young plants have acquired sufficient strength. Later on they should be transplanted in baskets made of bamboo or vacoa, and when strong enough planted out in open ground.

It is as yet hardly possible to tell from what varieties seeds had better be taken; that is to say, what varieties bear the best seeds. We must of course in preference gather panicles from the best canes. although there is no certainty that a better result will be obtained, as the seed will produce canes having no analogy either in size or colour with the parent cane. One cane will give seedlings of all shapes and characters, with stems generally of a reddish colour, or sometimes white, but very seldom striped.

The sowings made this year at the "Station" have succeeded fairly well; but, as was the case last year, seeds gathered at Réduit or in the neighbourhood, whether collected on old varieties or on seedling varieties, were very nearly all unfertile, and almost completely failed.

Thus in an experiment in which each lot was sown in an equal surface of bed the results were as follows:—Fifteen lots were a failure; one lot yielded one plant; two lots gave each three plants. Seeds from other places and sown on ground of equal surface yielded:—

No.	Plants.	No.	Plants.
18	55	79	116
27	104	87	13
33	57	Lousier	2
36	180	Bambou	5
53	80	Penang	255
75	42		

Yet all the flowers were gathered and the sowings made in the same manner.

It will therefore be seen that the fertility of seeds is very variable, and that it is necessary in the blooming season to collect many of them, and under different conditions, in order to be sure to get some of good quality. Upon the whole we obtained this year comparatively a large number of young plants. A good many were destroyed by worms when still in beds, but about 5,700 could be put in baskets, out of which 3,900 resisted the attacks of insects, borers, &c., and attained sufficient strength to be planted out in open ground. About

2,200 of the above were planted at Réduit, and 1,700 distributed to different planters, who undertook to cultivate them and propagate them if advisable.

In answer to certain remarks made on this subject we may observe that there has been, properly speaking, no distribution; the canes which were given out may prove either bad or good varieties, and the latter will probably be a small number. This must be studied, and as the plants raised have been very numerous this year, the selection will be made more easily and more rapidly by dividing the work and sharing it with a few proprietors who have kindly undertaken to co-operate.

All the young canes which are planted out do not thrive; a certain number die before they make stalk, but those which resist and develop should be propagated by slips afterwards, and it is only after the first reproduction that an opinion can be formed of their approximate value. The canes which give indifferent results may be abandoned; but the best varieties should be extensively propagated. Granting that only ten holes of each variety are planted, 250 plants will be enough as a first trial to plant an acre, which, if the ratoons are to be followed up, should be left unmoved for three or four years; double that area will be necessary if one wishes to renew the experiment, and it is well known that this is not too much to experiment with a given variety of cane. It will be seen at once what a comparatively large area is necessary to test the new seedling varieties, and how great is the usefulness of collaboration when there is a large number of plants raised. Such collaboration is likewise useful to propagate by cuttings the first true canes produced. As we said before, the more numerous the trials the sooner the worth of these new varieties will be determined. With such a system only a few eyes or buds can be distributed to begin with, and before making the selection. It is not, therefore, possible to issue good canes at present, as the selection of the new varieties is not completed; that must be left to the person who has charge of the plants, and he will propagate those canes which in his opinion are of vigorous growth. It will consequently not be possible to make a distribution of the new seedling varieties until the work of selection has been completed, and it must be well understood that people who are given plants at present must undertake that work themselves, to collaborate with or complete the experiments carried on at the "Station."

This year seeds gathered in July were sown a few days after; the

young plants which had been put in baskets six weeks or two months later were planted out permanently in December or January following. Their growth was generally more active than those of last year, as several plants had already sent up shoots from 2 to 3 feet high two or three months after their plantation in January. Such precocity has never been observed before, but it should be borne in mind that the season was much more favourable this year, whilst last year's drought was probably the main cause of the delay. This quick growth holds out hopes that some canes among the new varieties will develop more readily than others, and will allow the period to be extended during which plantations can be made in a given locality.

Results of the reaping of the Seedling Sugar Canes.

The seedling canes were reaped as ratoons on the 10th December, 1897, having been cut as virgin canes on 30th October, 1896, and having received chemical manures on the 18th December following. They did not give the results that might have been obtained in an ordinary year and if the abnormal drought which prevailed in 1896 affected some varieties and materially reduced their yields, on the other hand it directed attention to other varieties which appeared to resist better and to yield comparatively satisfactory results. It is possible that some weakly varieties might have developed a better growth in an ordinary season, but several years of cultivation are necessary before it is possible to assign to any variety of sugar cane the place that it deserves. Some seedlings, very inferior as plant canes, also yielded a very poor return as ratoons; the same failure having been observed on the same canes grown under different conditions, they were eliminated, and only those kinds were replanted which had given the best results. Of these there is a sufficient number, with the seedlings to be raised hereafter, to allow a selection to be made of the kinds which will be definitely adopted.

The reaping was effected under the ordinary conditions; all the lots were weighed and the yields computed from the number of holes of each kind. In our last Report we pointed out that the yield of some lots was exaggerated because they were contiguous to other lots where the canes had remained of stunted growth and had in consequence benefited from the larger space available—the inconvenience was remedied to a great extent this year by reason of the less exuberant vegetation of the plants, and the canes had ample room for their development and did not crowd each other. From all the plots,

tops were retained for planting and the saccharine content of the canes was determined by selecting as samples from each lot from 20 to 25 canes which were crushed in the laboratory mill. This sampling was easier than last year with plant canes, and the analyses come nearer the truth. It should be remembered that all these seedlings (except a few varieties) were obtained from *Beau Champ* estate, and also except the P. canes which are also raised from seed but which come from the Royal Kew Gardens. We have already remarked that in some cases the canes which have been sent to us, bearing the same number, were different. Some mistakes must undoubtedly have occurred in transmitting these canes, as two varieties bearing the same number are not identical. There is in consequence much difficulty in identifying the same varieties grown on different estates under different numbers. Many varieties resemble each other closely in colour, foliage, &c., and the greater the number and the more the colour and *habit* vary from their being more or less vigorous, as plant canes or ratoons, the greater the difficulty in identification. This inconvenience will unfortunately increase in proportion as a larger number of varieties are obtained and are spread over all parts of the Island.

In a communication made to the Chamber of Agriculture, Mr. Perromat produced samples of canes some of which are not similar to those which were supplied to us—such is the case with No. 18 which gave comparatively poor results at the Station; with No. 51, which is green, while our two samples are black; and with Nos. 79, 90, &c.—On the other hand, Nos. 33, 58, 65, &c., are obviously identical on both sides, and can be easily recognised.

Upon the whole, besides No. 33, which, at the present time—and justly so—is in great demand, there are many other kinds which, both as ratoon and plant canes, yielded very satisfactory results. There is very good reason to seek out and propagate No. 33, notwithstanding its creeping habit, which is a drawback in certain districts. This cane generally grows well everywhere, but it is a mistake to adopt this single variety and neglect the others. No doubt a planter cannot grow and investigate all the varieties of seedlings that exist, but among the better kinds he might at least select ten of the best, and cultivate them at the same time and under similar conditions, on a few acres, in order to propagate afterwards those among them which give the best products. Everybody knows what has happened hitherto; all the new kinds of canes, introduced from time to time, have dis-

appeared, or nearly so, or have yielded poorer and poorer results after having enjoyed public favour during several consecutive years; other canes showed alternate periods of good and bad yields. It is in the interest, therefore, of every estate to have several varieties in cultivation, especially if none possesses indisputable superiority, because generally one variety will, according to the season, the atmospheric conditions, or other undetermined causes, give better results than the others; and thus the fact of having different varieties cultivated together may ensure a general level in the annual production of an estate. The value of a sugar cane is not determined by its first crop, because one variety may give a splendid first crop and a very poor yield in ratoons. Under certain conditions this might be an advantage worthy of consideration, but in Mauritius, where the expenses of putting land under cultivation and planting are heavy, leaving out of consideration the longer time the land is occupied without bearing, the cane which ratoons well has a marked superiority, because the cost of production is much lower for the crops following the first crop; besides, during hurricane weather—since these atmospheric disturbances must always be taken into account—ratoons are less liable to being damaged or destroyed.

The canes in our experimental field were kept as 2nd ratoons, although amongst them are some whose vegetation is too languid to give a normal yield.

It was found that some numbers appear to give good results both as plant and ratoon canes.

At the present time No. 33 is the most in favour, but No. 65 is also in demand, though it did not apparently yield better results at Réduit than many other varieties, giving out shoots not so fine in appearance, but tillering better, especially as ratoons.

Some varieties were attacked by gum, but, as a rule, to a less extent than last year. Traces of gum were also observed on the Lousier, which, although grown under the same conditions, yielded thie year poorer results than most of the seedlings. This cane, which is the widest spread in the Colony, presented in several localities obvious symptoms of decline. And this would be the proper time to propagate the most valuable seedling varieties to supply the place of the Lousier where it no longer gives its normal yield.

Besides those seedling canes of fine appearance, that is to say, large and prolific, there are some of smaller size, rather slim than thick, frequently with rather flattened stalks, and generally of a dark red

colour, with a good tendency to tiller, and giving comparatively long canes, to all appearances sound and vigorous. All these canes are apparently well grown, and deserve to be tried on a large scale.

Improvement on the Sugar Cane by Selection.

The question of the improvement of the varieties of the cultivated canes by selection, or their degeneration due to the methods usually employed for their propagation, is a frequent theme of inquiry and we have thought it useful to pursue a few experiments in order to contribute to the investigation of certain points under discussion, which are far from being completely elucidated.

The improvement of the sugar cane by planting slips from canes richest in sugar contents was tried a few years ago on Calumet Estate, Louisiana, by Mr. Edson, who is said to have obtained good results. We have also begun an experiment which will be continued year after year until some solution is arrived at, one way or another.

Selection has given remarkable results in the case of certain plants, sugar beet for instance, and it is on the strength of these unquestionable results that the same method has often been recommended for the sugar cane; but it is not certain that the same results will be obtained. At any rate we believe that improvement will take more time and be more difficult to obtain; but that is no sufficient reason for abstaining from action. The difference between the two plants is so great that there is no imperative reason why the methods successfully employed in one case must necessarily succeed in the other. Every beet or analogous plant constitutes a well characterised individuality which neither a cane nor a cluster of canes possesses; the seeds produced by a beet plant yield in their turn well defined and numerous individuals from among which those that come nearer the type desired to be produced, or improved, can be selected. In the sugar cane—without speaking of seeds which do not reproduce absolutely the characteristics of the parent plant—there is likewise a great range of variation as much in the sugar contents or the development of the different shoots from the same stool, as in the canes sprung from a single bud; but these variations are chiefly attributable to the stage of growth developed by a particular stalk, to its age, &c., and the great difficulty is not to select the richest cane, but that whose greater richness is due to the special quality of the individual, and not to the date of its appearance on the stool which was the determining cause of its becoming a mature cane or a *baba*.

In this investigation is it preferable to choose the stalks from the same or different stools?

In our opinion, as each stool is produced from a single bud, it is better to select from several stools those canes of the same outward appearance as regards growth and vegetation and as far as possible of the same age; as on the same stool canes are to be found at different stages of growth and endowed with wide differences in saccharine richness. To select the richest plants it is sufficient simply to analyse the same portion of each cane; by this method the average richness of the cane is not arrived at, but comparative figures are obtained which are sufficient for the purpose. It was on these lines that we proceeded; the central portions of the canes were crushed in the mill for the chemical analysis of the juice, and the extremities were reserved for planting by the eyes or buds.

In February, 1894, six average identical canes were experimented with in this manner and the juice exhibited the following composition:—

	1	2	3	4	5	6
Density at 15° ..	107·7 ..	107·8 ..	108·5 ..	107·7 ..	107·8 ..	108·3
Sucrose p. 100 c.c.	17·46 ..	18·14 ..	19·44 ..	17·98 ..	17·82 ..	19·60

Nos. 1, 4 and 5 were taken as poor, and Nos. 3 and 6 as rich canes—No. 2 being eliminated; the three first canes gave an average richness of sucrose 13·85 and glucose 0·35 per 100 of canes; the two remaining yielded sucrose 15·12 and glucose 0·30.

Seven other canes were crushed which yielded the following results:—

	1	2	3	4	5	6	7
Density at 15° ..	107·7	107·8	108·3	108·1	107.6	108·2	107·6
Sucrose p. 100 c.c.	17·65	18·14	19·65	18·45	17·65	19·50	17·90

Nos. 1 and 5, with an average composition of 13·76 sucrose and 0·27 glucose, were classed as poor canes, and Nos. 3 and 6 as rich canes, with an average composition of sucrose 15·02 and glucose 0·19 per 100 of canes; Nos. 2, 4 and 7 were rejected.

These canes were cut by joints and planted out separately; the conditions of culture, manuring, &c., were of course similar in both plots. The buds were first separated into two categories, those of the lower part and those of the upper part of the cane, but the latter alone sprouted regularly; those from the *butts* scarcely giving any plants.

The sugar content of the canes, reaped on 17th December, 1895, was as follows:—

	(R.) Rich Division.	(P.) Poor Division.
Density of juice at 15°	107·65	107·50
Baumé	10·4	10·2
Per 100 c.c. Sucrose	18·03	17·50
,, ,, Glucose	0·64	0·94
Per 100 of canes, Sucrose	14·06	13·66
,, ,, Glucose	0·49	0·73
Quotient of Glucose	3·5	5·3
Purity	89·5	88·4

The difference between the two plots is small, especially if the difficulty in sampling is taken into account; it is fair to add that the Port Mackay cane, growing more erect than the Lousier, is easier to take samples from, and was for this reason selected in preference to any other variety.

In order to emphasize the variations caused by selection we did not compare the results yielded by the cane taken for selection with those of average canes, but we sought on the one hand to improve the sugar cane by selecting the richest canes, and on the other to reduce the richness by taking from the same field the poorest stalks.

After the virgin canes had been cut the same operation was continued; that is to say, the richest canes were selected from the rich plot and the poorest from the poor plot and planted out.

From each of these plots 24 canes were retained to continue the selection with; the lower quarter of each being crushed in the mill; this portion, which sprouts with difficulty, was reserved for chemical analysis in order to keep the upper remaining joints for planting; besides, the canes were classified according to the density of the juice in order to experiment with a larger number of canes.

From plot (R) 16 canes were taken having a density ranging between 107·4 and 108·2; the 8 remaining canes having a density varying from 106·5 and 107·3 were eliminated.

From plot (P) 9 canes were chosen with density varying from 106·1 to 107·4; the 15 remaining, with density varying from 107·5 to 108·2, were eliminated.

The mixed juices of each plot yielded the following composition:—

(B.)

		Rich division.	Poor division.
Density of juice at 15°		108·1	104·4
Per 100 c.c.	Sucrose =	19·14	16·19
	Glucose =	0·43	0·87
Per 100 of canes	Sucrose =	14·86	13·60
	Glucose =	0·33	0·73
Quotient of Glucose	=	2·2	5·3
Purity	=	88·9	88·9

These two plots were planted in view of another experiment in December, 1895.

The canes taken from plot B and obtained from a previous selection were reaped as plants on December, 1897; that is to say, about a fortnight after the cyclone of the 6th December, which caused a reduction in their saccharine strength.

It is somewhat late for reaping plant canes, but as the same canes have to be replanted, the crop has to be put off until the favourable time for planting.

30 average canes were analysed with the following results:—

		Rich division.	Poor division.
Density of juice 15°		107·5	107·06
Per 100 c. c.	Sucrose =	16·93	17·00
	Glucose =	0·78	0·74
Per 100 of canes	Sucrose =	13·22	13·26
	Glucose =	0·59	0·57
Quotient of Glucose	=	4·5	4·2
Purity	=	85·4	84·6

Hitherto no difference is to be seen between the two lots, and we fear it will be the same later on, or in any case if there be any improvement that it will be insignificant and difficult to appreciate. On reaping the above plots, and for the third time, 26 canes were selected; the lower third of each being crushed separately by the mill. The density of juice per each cane of plot R varied from 105·6 to 108·4 and was on the average 107·38; that of plot P varied from 105·2 to 108·2 with an average of 107·38.

From plot R 11 canes with density varying between 107·9 and 108·6, and from plot P 14 canes with density between 105·4 and 107·7 were selected for the new plantation.

The mixed juices on being analysed showed the following composition:—

		Rich division.	Poor division.
Density of juice at 15°		108·4	107·6
Per 100 of juice	Sucrose =	18·41	17·28
	Glucose =	0·48	0·72
Per 100 of canes	Sucrose =	15·46	13·49
	Glucose =	0·40	0·54
Quotient of Glucose	=	2·6	4·1
Purity	=	89·7	86·1

This last plantation will only be reaped at the end of 1899. The long period necessary for the production of every crop of cane is a great hindrance to this class of investigation.

SUGAR REFINING IN AMSTERDAM A HUNDRED YEARS AGO.

By Dr. E. von Lippmann.

An exhaustive paper under the above title appeared in the Zeitschrift des Vereins der Deutschen Zucker-Industrie for April, 1899, Vol. 49. The limits of our publication prevent us from giving more than a summary which will no doubt prove to be of interest to our readers from an historical point of view.

In the 13th Section of his most valuable and interesting book, "Geschichte des Zuckers," Dr. E. von Lippmann stated that the first complete work on sugar refining was "L'art de raffiner le sucre," by Duhamel du Monceau, published in 1764, and he also gave an abstract of its contents, and pointed out that the later works of Halleus (1765), Beckman (1780), Busch (1790), Nicolai (1792), Bohmer (1794), Gotthard (1805), Soltau (1820), etc., were in fact founded upon that of Duhamel; this was he believed, a complete list of works of that period on the subject. A visit recently paid by Dr. von Lippmann to Mr. A. Sparkler (Sparkler & Tetterode, refiners), in Amsterdam, revealed the existence of a work which he had never hitherto met with, and which had been in the possession of the above firm for a very long time.

The book was published by A. Blussé & Sohn, in 1793, and its author, J. H. Reisig, was, according to information contained in the preface, a man who devoted the greater part of his life to the management of one of the first Amsterdam refineries. The title is "De Suckerraffinadeur, of volledige Beschryving van het Suiker, deszelfs Aankweking, Bereiding en Verzending, met de Opgaave der verschillende Bewerking, Molens, Fabrieken, enz., in en buiten Europa." *

In the first section of his book, the author gives a description of sugar, its chemical and physical properties, and the way in which it is prepared from cane. He then proceeds to give advice about the planting of the shoots and the treatment of the soil; the end of the section is devoted to a description of the factory, and the mode of producing the sugar from the cane. The chief portion of the works was a grinding mill having three rollers for crushing the cane, which was done twice. To clarify the juice, a mixture obtained by stirring a number of herbs and roots, plant ash, and lime with water was used;

* "The Sugar Refiner, or a complete description of sugar, its production, preparation and distribution, with an indication of the various methods of working, mills, factories &c., in and outside Europe."

but if the juice was poor and viscous, potash or lime were employed. Five vessels were used for boiling. In the first the syrup was gradually heated and the scum removed, in the second, third, and fourth it was clarified, and in the last, concentrated to the right point, *butter being added.* As soon as ready it was cooled, and transferred for crystallization to large barrels, with holes in the bottom, through which the excess of liquor drained. After several days the process was complete, the barrels were made up and were ready for sending away, although further purification might be effected by boiling and treatment with clay. This however did not result in the obtaining of one uniform product, but of three—tops, middles and "foots"—and required at least two months. Up to 1740, the Amsterdam refineries to a large extent controlled the market, and supplied Austria, Germany, and Spain almost without competition. The profits were large and easily gained, and the refineries were worked upon old fashioned lines, without any idea of progress, until, believing they were indispensable, they began to produce lower and lower qualities of sugar, and even to adulterate it. Competition with the 120 Amsterdam refineries then sprang up in Rotterdam (40 refineries), Brabant, Hamburg (200 refineries), and St. Petersburg (80 refineries), and large quantities were also exported, with the help of large bounties, from England. Then the refiners saw that they would be compelled to give up working by rule of thumb, and adopt new and rational lines to improve their processes, so as to cope with the adverse circumstances produced by competition.

In section three, the author describes the erection of a refinery. A medium sized one should be about 150 feet long and 30 feet wide; and it was advisable to have a separate building for storing the raw sugar. The factory contained at least four pans (each 6 feet deep and 12 to 14 feet wide), and in near proximity a liming vat of the same size, the contents of which would last for three or four months; from three to five coppered clarifying vessels holding about 80 or 90 cwt. of sugar each, heated separately; the scum vat, lined with lead (9 × 8 × 3 feet), the form and candy-pot trough also being lined with lead; the earthenware trough, in which was prepared the clay for clarifying, not requiring to be lined. There were, further, two heating rooms, 10 feet wide, 12 feet long, and 20 feet high, for drying the loaves, and crystallizing the candy, and finally a whole nest of candy pots, and a large number of forms for lumps and "baster," made of fine earthenware and hooped, where necessary.

In section four, the author mentions that the proper preparation of the lime water is a most important matter, because on its efficiency in a great measure depends the success of the refining operations.

The best clay for clearing was obtained from Rouen, and was formerly procured without cost, being brought over as ships' ballast. Later, however, it became very expensive. Before using it was thoroughly washed with water.

The preparation of the numerous forms of clay paste required considerable experience. The writer calls attention to the dangers of fermentation of any residua of the syrups left in the pots, etc., to prevent which, the pots ought to be thoroughly washed from time to time. The water from this washing, when it acquired a certain concentration, was usually sold to distillers, who made alcohol from it.

In section five, the different kinds of sugar produced by the factories are described and the advisability indicated of assorting the raw sugars and of working up similar qualities together, avoiding the mixing of two qualities, and attention is called to the necessity of carefully weighing the raw sugar when purchased.

For dissolving the raw sugar the use of pure fresh water only is recommended; the fine cleared raw sugar and the American (so-called) powder sugar should be dissolved in the evening and the heating commenced about midnight, great care being taken to stir continuously and to prevent boiling over and burning. After half an hour the syrup was to be skimmed, lime water added and clarification effected by the addition of eggs. The liquor was then repeatedly skimmed until perfectly clear, which usually required about four hours, and was then filtered through into the clairce store-vat. As the clarifying of the contents of each pan required about 70 to 90 eggs, equal to a daily consumption of about 400 or 500, this naturally was a considerable expense, to avoid which bullocks' blood was used instead. Many disadvantages, however, resulted from this, especially when not fresh and free from smell; the loaf sugar became coloured and could not be kept; the candy sugar acquired an unpleasant odour, and the adherent or enclosed mother-liquor decomposed. Naturally, this affected the sugar industry of Holland very unfavourably, and the State, on the plea that bad blood spread disease, forbade the use of blood altogether, but as the enforcing of the prohibition was left in the hands of the "bloed-facteurs" the practice was still carried on.

For the manufacture of candy the clairce was heated up quickly, and butter added to prevent frothing. When the proper concentration

was reached, the fires were drawn and the syrup removed into pots, which were stored in a previously heated room. Good crystallization was dependent upon temperature and concentration, and very slow undisturbed cooling. The finished candy was sorted and packed in baskets or boxes. The syrup from the candy yielded a candy of lower quality, or was worked up into other products. The time for cooling required by the white candy made from the best American clarified powder sugar, or from refined sugar waste, was from six to seven days; candies of lower quality took a few days longer.

The finest refined sugar or candy loaf, known as "canary loaf," could, like the white candy, be made only from the best nearly white clarified sugars, or powder sugar of American origin, or from the waste of white sugar, to which was usually added the runnings from the white candy, the fine cleared syrup, and the last white syrup from the loaf manufacture. The clarifying was done by adding very little limewater, but a considerable amount of albumen, and by careful filtration of the liquor through cloth, and concentration by evaporation. The author emphasizes the care with which this process had to be conducted. and gives advice as to controlling the firing, the addition of butter, the sampling, &c. The boiling finished, the syrup was transferred to a cooler, and allowed to cool whilst being stirred, some powder sugar being not unfrequently added. When sufficiently cooled another finished boiling was added, well stirred and cooled, this process being repeated until the cooler was full. The masse-cuite was now emptied into the forms, the contents, while cooling, being stirred to prevent the larger crystals from settling down. The clearing commenced when the masses were completely cold (after about 24 hours), and on an average occupied about twenty days. The loaves were taken up in baskets, the linen-laps removed, and the forms fixed vertically upon the pots. After a few days the syrup had run off; 50 cwt. of loaves yielded from 12 to 14 cwt. of syrup. After examining the loaves the surface was cleaned, and then followed the first clearing with clay, which was left on until it became quite dry, and could be removed in the form of a cake. The clearing was repeated after two or three days. Two or three clearings were, as a rule, sufficient to make the loaves neat. The syrup from the clearing was now collected in large pots for further working up. The loaves were put on fresh pots until the whole of the syrup had run off; 50 cwt. of loaves yielded 2 to 3 cwt. of syrup. Finally the loaves were dried in a chamber which was slowly heated

so as to reach the highest temperature in from four to six days. This was maintained for a few days, and the chamber then allowed to cool slowly for four days. The loaves were then packed.

The quality of all the products is stated to depend on the proper mixing of the syrups and sugars. The various sugars and processes are fully described and illustrated, including the process for making the "lomps" and heavy loaves, of which a boiling contained 130. The running off of the syrup and the clearing required a very long time. When the "lomps" were clean they were removed and worked up into refined sugar of lower quality, the tops being first cut off, which, like the clearing syrup, were boiled into "lomps." The unclarified syrup of the "melis" and "lomps," often also a part of the cleared syrup, further the "melis" and scum-water, as well as all suitable runnings of low quality, formed the source of the last product, the "basters."

The production of the "basters" was similar to that of the "lomps," they required, however, much more time and room. The syrup running from them was not susceptible of further crystallization, and was sold as such. The "basters" were allowed to dry for five or six months, and, when a large number had been made they were chopped up into "farina."

Paragraph 10 is devoted to the qualifications, responsibilities, etc., of the manager and of the man who controls the boiling, and of other special workmen. Mention is made of the pay received by several of these, and finally the financial part of the refinery is discussed in this chapter.

Even at this early period the sugar industry was beset with certain troubles and difficulties. One of these was the "Black Loaf," which had been known to some extent for a long time, the first communication on the subject, by van Dyk and van Beek, appearing however only in Amsterdam about the year 1820.

Commencing very gradually at first, it grew in a year or two into a perfect pest. In the last stages of the loaf manufacture spots were noticed on the loaves, which on drying became black, rendering the sugar valueless. This evil attained such a height that pure white loaves could hardly be made, and as the practical men could not trace the cause, scientific aid was called in. Chemical and microscopical investigation of the black spots showed them to be a kind of fungus growth similar to certain confervæ, more especially the *Conferva mucoroides*, described by Agardh and K. Sprengel.

A thorough examination of the sugar factories led to the discovery of the original location of the evil, viz., in the form troughs, where

all the implements, pots, forms, etc., were washed. The wash water being used for some time, the floors and sides of the form troughs were covered with a slippery slime, and the thick, dark water, with a faint acid reaction, and smelling of alcohol, deposited a brown substance identical in composition and appearance with the "black" from the sugar loaves.

Many experiments proved this to be correct. The factories were gradually restored to their former condition by thoroughly cleansing all apparatus with fresh water, and keeping the works completely clean and well ventilated.

The treatise is illustrated with a number of drawings giving the plan of a factory, of the different apparatus used, and even of some of the more difficult manipulations which had to be performed by the workmen.

THE STENTZEL PROCESS FOR PURIFICATION OF GREEN SYRUPS.

(Translated from the *Deutsche Zuckerindustrie.*)

At a meeting of the Verein der Deutschen Zucker-Industrie, held at Breslau on the 13th May, Dr. Drenckmann, of Halle, made remarks on various processes for purifying green syrups, &c., amongst others that brought out last season by Director Stentzel, of Eichenbarleben, which has since been made the subject of a patent. The method of working adopted in this process is as follows:—

TREATMENT OF THE SYRUP.—Dilution with pure thin syrup or sweet water, to which has been added a large quantity of lime—by a long and energetic boiling.

Then follows specially careful saturation with carbonic acid, after that exact neutralization of the alkalinity by sulphuration within the extreme limits of alkalinity, filtration through a filter composed of small pieces of wood. Separations, and still more decompositions of amorphous organic substances, succeed better by repetition of this proceeding; varying, if possible, the concentration or partly separating the accompanying crystallizable matters.

In the case of this method also, it is difficult to ascertain, by analysis of the products evolved, the purification effected. Even careful analysis of the separation scums, carried out in the laboratory of the Verein, does not allow of definite conclusions being reached. From the large evolution of ammonia in the chief process of the

purification, the conclusion may be drawn that complete decomposition of nitrogenous compounds, probably of amid acids, takes place. The successful results are of course largely due to the exact regulation of the increasing alkalinity of the syrups, which in itself would prevent crystallization, also to the mixing of the runnings improved by the purifying process with such sugar solutions as crystallize well at the first jet. As a matter of fact, the syrups and masse-cuites from the after-working shew splendid qualities in regard to brightness, colour and capability of separation of the syrups. All danger of inversion is excluded in this process. Of course the quotients of the after-work will fall towards the end of the campaign. The products, however, even the more inferior sugars, look well and in no way deteriorated.

From 100 beets there are produced at Eichenbarleben

1st Sugar	12·07	Rendement	90·82
2nd ,, ...	1·35	,, ...	75·43
Molasses	1·53	Quotient	55·9

The extra daily expenditure with this process consists chiefly in the use of a little more fuel, while the increase in that of lime and sulphur is scarcely noticeable.

Dr. von Lippman agreed with the view that the principal merit of this process consisted in there being an actual separation between the green syrups running off from the first sugar, and consequently the sugar obtainable from them, and that pure first product sugar obtained from the isolated thick juice. Mr. Stentzel had at once come to the conclusion not to mix the sugars obtained by his system from the green syrups, with the first product of pure quality, but to sample and sell the latter by itself. It was very apparent that, even with very thorough purification, the sugars obtained were still decidedly inferior to the pure first product. For certain reasons this was not so easily demonstrable in the case of other processes that had been mentioned, and he believed that on the whole great care must still be exercised in arriving at any conclusion with regard to those processes. At the Vienna Congress, at which first-class manufacturers and chemists from all the sugar producing countries were present he (Dr. v. Lippmann) had demanded who among them all, who had been working with these most varying systems, was able from his own experience or from trustworthy sources to report that the existence of any real purification had actually been proved, and there was no reply, and this was the best practical criticism they could have.

SUGAR-BEET CULTIVATION IN GREAT BRITAIN.

By Sigmund Stein,

Manager, Crosfield, Barrow & Co., Sugar Refiners, Liverpool.

The Government Board of Agriculture publishes in the Journal of the Board of Agriculture for June 1899, Vol. 6, page 45, the following statements relating to experiments of growing sugar beetroots in Great Britain, in the year 1898.

The special Committee of the Council of the Chamber of Agriculture reported to the Government Board of Agriculture that they addressed a form of enquiry to 400 intending experimenters embodying the particulars desired of the experiments made during the past season. Replies to their circular were received in 143 instances. Many of these, however, proved to be experiments conducted on very small plots of land, and it was only in cases where the surface under experiment was not less than a quarter of an acre, that further details were requested as to results.

From these, sixty-five persons sent in information, and furnished particulars as regards seventy-seven separate plots sown with beetroots in the year 1898.

The experiments have been carried on in thirty different counties in Great Britain. In seventeen cases the information sent was incomplete as regards the weight of the crop or the analysis of the roots.

In a few cases, owing to the excessive drought, the experiments were failures. The dates of sewing varied from the end of April to the beginning of May, and the quantity of seed used per acre was on the average between 8 and 10 lbs.

In regard to the cultivation, such as ploughing, working, rolling, and horse and hand hoeing, the same system was applied as in the case of mangolds. In some instances, owing to the extreme hardness of the ground, the pickaxe had to be employed.

The answers as to the cost of growing the beetroots were not quite uniform in scope or complete in form.

The Committee states that while they showed the cost of growing sugar beetroots and mangolds to be approximately the same, it might be regarded as certain that the cost of growing the former is more than that of growing mangolds in respect of at least two items, viz., the cleaning of the land, and the lifting and cleaning of the roots.

The year 1898 was characterised by most unusual meteorological conditions, to which the Committee refers as follows:—

"It should be noted that the season of 1898 was of an "exceptional character, and probably favourable to the cultivation "of sugar beet, although in many of the districts there was a "drought which practically killed the plants. Very cold weather "was experienced during May and June, but during the import- "ant months of July and August the rainfall of the kingdom "was considerably less, and the period of bright sunshine was "more than the average."

The year 1898 was one in which the yield of mangolds in Great Britain is calculated at 17·65 tons per acre. The average yield of sugar beetroots in the experimental plots shews 24·2 tons with leaves, and 16·3 without leaves.

The experimenters with sugar beets have also stated their estimated yields of mangolds in the same season. The figures given vary from 20 to 40 tons, and the average statistics given shew the production of mangolds per acre to be 26·2 tons.

As regards the geographical situation of the plots grown, same were as follows:—

ENGLAND.

County	Essex .. .	2	County	Salop	15
,,	Lincoln	5	,,	Somerset	2
,,	Middlesex ..	1	,,	Wilts	6
,,	Norfolk	4	,,	Worcester	2
,,	Hants	12	,,	Chester	2
,,	Kent	10	,,	Cumberland ..	5
,,	Leicester.. ..	1			—
,,	Warwick	8		Total in England..	76
,,	Cornwall.. ..	1			

WALES.

County Flint 1

SCOTLAND.

County Aberdeen 2

,, Ayr 3

Making a total of 82 experiments in England, Wales, and Scotland.

Out of these 82, the analyses in 53 cases were made and reported on by myself to the Central Chamber of Agriculture.

From the tables published by the Government Board of Agriculture, the sugar beetroots grown last year shew:—

	Sugar in 100 parts juice.		Average quotient of purity.		Average quantity of sugar in 100 parts of the roots.
For Great Britain ..	15·65	..	85·19	..	14·48

I have averaged and compared the data at my disposal relating to the yields in the different beet growing countries of Europe and the United States for the last seven years, which are as follows :—

	Sugar in 100 parts juice.		Average quotient of purity.		Average quantity of sugar in 100 parts of the roots.
Germany	15·08	.	86·24	..	14·20
Austria	14·11	..	84·90	..	13·40
Hungary	14·20	..	84·26	..	13·60
France	13·85	..	84·10	..	13·05
Belgium	15·31	..	87·85	..	14·37
Holland	13·99	..	85·57	..	13·23
Russia	14·26	..	86·66	..	13·70
Sweden	13·92	..	84·73	..	13·17
Spain	15·75	..	87·38	..	14·62
Roumania..	15·26	..	87·13	..	14·36
Greece	11·49	..	82·77	..	11·00
Bulgaria	13·84	..	83·77	..	13·25
Italy	14·11	..	86·06	..	13·41
United States of America	14·56	..	83·91	..	13·88

UNIFORM METHODS OF TESTING SUGAR.

We have been favoured with the following translation of a report submitted by Dr. Herzfeld, of Berlin, on behalf of the Chemists' Commission appointed to promote uniform methods for testing sugars.

"In reply to your enquiry, I would report as follows respecting the present position of the Commission for uniform methods of testing sugars:—

1. The Commission has decided, as you were made aware by the Vienna protocol, that a number of fresh faults in polarization having been discovered, the examination of the quartz plates should be repeated, only such quartz plates to be used, the thickness and utility of which had been tested and placed beyond doubt by the Imperial Institute of Physics. The supplying of such plates has caused great difficulty. The Institute has condemned the greater portion of the material which I sent in immediately after the Vienna meeting, and is at present still occupied with testing the specially prepared new plates asked for. As soon as the Institute has returned

these to me, I shall distribute them to the members of the Commission, but from past experience I have little hope that this can be done before the 1st of October next. I have to add that in addition to the American Government Chemist, Wiley., who took part in the Vienna meeting, the Russian sugar factories have notified that they would depute Prof. Bunge, of Kieff, to the Commission.

2. The Commission has requested me, at the suggestion of Dr. Hermann, of Hamburg, to publish a table of the methods used in the various countries, material to be supplied by the Delegates. My request for this information has been complied with by all excepting the Italian Delegate, and I intend having the table printed shortly and sent to the members of the Commission. I then propose, on the occasion of the Paris Exhibition, to summon a meeting of the members, at which I hope English will also be present. The attempt would then be made to agree on uniform methods on the basis of the table. Such a good opportunity for a Congress will probably not easily occur again. I should like already to state my opinion that the basis for uniformity should in the main be the Austrian method rather than the German one, because the former is without doubt better than ours. It would also seem judicious to advocate the Austrian method, as other nations would thus recognise our impartiality and be more ready to come to an agreement.

I need not mention that I shall do my best to attain this result next year. It might do good if your Association were to urge the Imperial Institute to hasten the testing of the quartz plates, because the authority in question combines exactitude with slow progress, and for that reason I am inclined to fear that I shall not get the plates in good time. If at the time of the adoption of uniform methods we do not also have a standard for testing the polariscopes, the difference in the results of analyses can hardly be done away with.

June, 1899.

From Java we learn that the weather has been exceedingly favourable to the crop; alternate rain and hot sunshine, the very thing that was wanted. The cane, which did not look promising some months ago, has benefited largely by the weather, and though the coming crop will by no means be equal to last year's abundant yield, it will, any way, prove a good average one. Almost all the sugar still to be made at the time of writing (May) had been already sold at very satisfactory prices, so that manufacturers are in good spirits.

XANTHINE BASES IN SUGAR CANE.

By Edmund C. Shorey.

If a sample of cane juice be clarified in the ordinary way with lead subacetate, the excess of lead removed by sodium carbonate, or hydrogen sulphide, the solution made alkaline with sodium hydroxide, if not already so, a few drops of Fehling's solution added, and heated to a boiling, a whitish precipitate is formed which rapidly becomes green. This was thought to indicate the presence of xanthine bodies. When solutions containing xanthine bases and reducing bodies are treated in this way with Fehling's solution, cuprous oxide is first formed by the action of the reducing bodies, and with this cuprous oxide the xanthine bases unite forming a greenish-white precipitate, Cu_2 combining with one molecule of the xanthine body. If the Fehling's solution be in excess, and there be also an excess of reducing bodies present, there is of course an excess of cuprous oxide formed, the red colour of which hides that of the xanthine compound.

In order to isolate the suspected xanthine base, about ten liters of cane juice were treated in the way outlined above, enough Fehling's solution being added to give a decidedly red precipitate, the solution filtered, the precipitate well washed, and dissolved in dilute nitric acid. To this solution ammoniacal silver nitrate was added, when a dirty brown precipitate was thrown down.

This silver nitrate precipitate was found to dissolve in nitric acid (sp. gr. 1·10) somewhat slowly on boiling, and the solution so obtained deposited crystals slowly. This indicated the presence of guanine and possibly also of xanthine. A portion of the silver nitrate precipitate was treated with dilute hydrochloric acid, filtered from silver chloride, and the solution evaporated, when crystals were formed having the characteristic microscopic appearance of guanine hydrochloride. The crystals were all of one form, and none of the characteristic crystals of xanthine hydrochloride were observed, proving that no other xanthine body than guanine was present in any quantity.

The guanine hydrochloride so obtained, when treated in water solution with an excess of ammonia, yielded a flocculent white precipitate of guanine, insoluble in water, alcohol, ether, and hot dilute ammonia. This guanine was further identified by Strecker's test—evaporation to dryness with nitric acid and treatment of the

residue with caustic potash, when, on heating, a yellowish red colouration is obtained: also by its conversion into xanthine by nitrous acid:—

$$C_5H_5N_5O + HNO_2 = C_5H_4N_4O_2 + N_2 + H_2O,$$

and the formation of the characteristic crystals of xanthine hydrochloride on treatment with hydrochloric acid.

This isolation and identification of guanine has been repeated on ten samples of juice from mature cane, and on four samples of refuse molasses, and in each case there has been no indication of the presence of any other xanthine body than guanine. It is reasonable then to conclude that in mature sugar cane guanine is the predominant and probably the only xanthine body present.

During the present season an attempt has been made to estimate the amount of guanine in cane juice, operating in the following manner: The juice was clarified with lead subacetate, the excess of lead removed by sodium carbonate, and to the filtrate from lead carbonate, heated to boiling, enough Fehling's solution was added to give a decidedly red precipitate; the solution was filtered and the precipitate well washed with hot water, and the nitrogen therein determined and calculated to guanine. One hundred grams of juice were used for each determination and the nitrogen determined by the Gunning method. An average of six samples of juice of approximately the same purity and composition gave

	Per cent.
Total nitrogen	0·0350
Guanine nitrogen	0·0012
Equivalent to guanine	0·0025

From the known properties of guanine it was thought that this body would go through the processes of sugar manufacture unchanged, but that inasmuch as some of the other nitrogenous bodies are removed during manufacture, the ratio of guanine nitrogen to total nitrogen would be higher in the refuse molasses than in the original juice. This conjecture was confirmed by guanine determinations in molasses. The average of four samples of refuse molasses of similar composition gave

	Per cent.
Total nitrogen	0·7140
Guanide nitrogen	0·0308
Equivalent to guanine	0·0660

In the samples of raw juice examined the ratio of total nitrogen is 100 : 3·42, while in the refuse molasses the ratio is 100 : 4·31.

The small amount of guanine present in cane juice is of little technical importance. The amount present in refuse molasses may however be worthy of note in considering the fertilizing or feeding value of the same.

In the analysis of sugar cane and its products the presence of guanine may introduce an error in some cases unless its presence be recognized. Three of these cases it may be well to note:—

1. In the estimation of reducing sugars in technical work the volumetric method with Fehling's solution is generally used, but sometimes when greater accuracy is wished the gravimetric method is used. Now we have already noted that xanthine bodies if present unite with the cuprous oxide formed, and while in the volumetric method this fact introduces no error—for the amount of copper precipitated is not affected—in the gravimetric method, by which the cuprous oxide is reduced in a stream of hydrogen, the error introduced is proportional to the amount of guanine or other xanthine base present. The guanine is not affected by the reducing process, and is weighed as copper. It is recommended then that when a gravimetric estimation of reducing sugars is to be made in low grade sugar-house products the electrolytic estimation of the copper be resorted to.

2. A solution of sodium phosphotungstate in sulphuric acid is commonly used as a precipitant of nitrogenous bodies. Guanine in solution is partially precipitated by this reagent not as a compound of phosphotungstic acid but with the sulphuric acid, this compound being sparingly soluble. This may lead to the nitrogen of guanine being credited to other bodies; *e.g.*, peptones. A preliminary treatment with sulphuric acid and filtering before addition of sodium phosphotungstate will remove this source of error.

3. When cane juice has been clarified with lead subacetate and mercuric nitrate added to the clear solution, a white precipitate is thrown down. This precipitate contains any amide bodies present and by some chemists this use of mercuric nitrate has been proposed or used as a proof of the presence of amide bodies. This is altogether unwarranted, for the mercuric nitrate precipitate contains any guanine present, so that the formation of a precipitate in this case is not only no indication of the amount of amide present, but no evidence of their presence at all.—*Journal of the American Chemical Society.*

INDIA.

Prospects for European Sugar.

In consequence of the levying of countervailing duties on bounty-fed sugar in India, the Austro-Hungarian Central-Union of Beet Sugar Manufacturers, acting in the interests of the exporters of sugar to that quarter, requested the Austrian Lloyd Co. to reduce the freight for sugars to the East Indies. The following is the reply of the Co. :—

The introduction of the compensatory duties in India was effected principally with a view to support the sugar producers there, and partly to meet the complaints of the exporters in Mauritius. As regards the former, the regulations adopted have up to now led to no result, as the Indian factories are not equipped with modern arrangements, and are hardly in a position, with their primitive systems, to compete. Again, if they were desirous of further extending the area for sugar planting, this cannot be done all at once. As a matter of fact the situation in India itself has not much improved, and the Indians will have to continue to rely on foreign and colonial imported sugar as hitherto, for which, in consequence of the compensatory duties, they will have to pay a higher price. The Mauritians also have at once taken advantage of the situation to raise their prices. On the other hand, it must be remembered that Cuba is still able to export but very little, and America has to look about for other sugar exporting countries, and has already indeed secured half the production of Java. As regards Egypt, the export of sugar will, as before, depend entirely on the requirements of America, and as it is probable that the latter will be compelled to buy a good deal from Egypt, the greater proportion of the Egyptian sugar will be sent to America in the raw state. Under these circumstances it is evident that the Austro-Hungarian exporters may still reckon on a paying business with India, and a good many contracts have already been closed. Finally, as regards the freights, the official council has to reply that there is no possibility of granting the reduction of 2s. asked for. With a freight of 14s. per ton exporters to India are in a position to compete, and in comparison with the service performed this freight is so exceedingly low that the Company could not possibly make any further sacrifice by reducing it.—*Die Deutsche Zuckerindustrie.*

GERMANY.

Jam and Marmalade Manufacture.

In our June issue we mentioned that Dr. Degener would shortly publish the results of his investigations in this country into the manner of conducting the above-mentioned industries in Great Britain. This statement has now appeared in the *Deutsche Zucker-industrie* of July 14th and 21st, and as the second section, "On the introduction into Germany of the Jam Industry on a large scale" is the one which will probably most concern our readers, we append a literal translation of a small but very interesting portion. No doubt those journals which are most directly connected with a jam and preserved fruit industry will give their readers a translation of the whole paper, which is much too voluminous for our space, and indeed is incomplete at the time of our going to press.

There already exist in Germany, apart from the factories which prepare the so-called treacle, plum and cherry jams, about fifty works occupied more or less in the jam industry, of which the largest are in Strassburg, Coblenz, Metz (Luxemburg). Their products are, however, very varying. A few produce only "gelatines," marmalades formed with gelatine, others manufacture them after the English type, and of good quality. The majority however bring into the market a product which, though it has a pleasant taste, does not by any means correspond to the definition "jam". This product is prepared from fruit residues of all kinds to which the pips from raspberries and currants are still frequently added intentionally, and which are largely imported from North America (California) in a more or less dried condition.

Mostly they are apple rejects from the dried fruit or from the preparation of fruit-wine, to which is added, after boiling, some fruit juice (10 to 20 per cent.), finally filling up with 50 to 70 per cent. of capillaire syrup.

These residues, especially the American ones, are by no means free from objection as to their origin, and to say the least, not tempting. The fruit-wine residues have been extracted, and contain only a comparatively small quantity of fruit syrup. The capillaire mostly contains sulphurous acid, and in consequence of the large quantity of acid dextrin is not easily digested, especially by children, quite apart from the amount of *gallisie* it contains, which here is so much higher in proportion in contrast to the 10 per cent. of syrup, which the (on the whole) more genuine English manufacturer generally adds.

These preparations, known to cautious people as "mixed fruit marmalades," must be characterised as very suspicious products, and should be examined by the food inspectors. I think they also contain saccharin and I considered it my duty to examine the composition of marmalade samples bought from every part of Germany and to publish the results of my investigation.

The superiority of the English marmalades over most of the German ones is due to the fact that the English manufacturer uses the quickly and easily absorbable true sugar for sweetening purposes, whilst the German manufacturer uses capillaire syrup. He believes that he is compelled to this by the very considerable tax imposed upon sugar, which is almost equal to the price of capillaire syrup (May 17th, 23·5 to 24 Mks. per 100 Kg.). I must say that I found this, unfortunately, to be the fact. I recently visited a marmalade factory which is now no longer in existence (having been closed for lack of fruit), which very properly used only fruit of the best quality and not unappetising residues, but they did not use sugar, but only capillaire syrup for sweetening. Judging from the taste, saccharin did not appear to have been added, although it is very frequently used by other factories.

Against such potato syrup marmalades those made with the highly taxed sugar naturally cannot compete. I am certainly no enemy of the syrup, it is quite indispensable to the marmalade industry, but everything must be reduced to the proper proportion.

If a healthy marmalade industry on a large scale is to be set up in Germany cane or beet sugar must be used as the sweetening substance, and the addition of potato syrup beyond a certain percentage must be permissible only under compulsory declaration, otherwise the manufacturer of the inferior stuff, even when using pure fruit, has an advantage of about 10 marks (56 kg. sugar = 24·60, against 60 kg. syrup = mks. 14·50), and this gives rise to unsound competition.

The matter would, however, be different if the consumption tax were remitted on beet sugar used in the manufacture of jam. In that caes, firstly: A compulsory declaration must be required for jams and marmalades containing more than a certain percentage of capillaire syrup. Secondly: A similar declaration for jams and marmalades containing an addition of residues of any kind. Finally: Any addition of saccharine must likewise be compulsorily declared.

FRANCE.

Dunkirk.—The British Consul reports a falling off of about 50 per cent. in the sugar reports for 1898, which is attributed to increased German competition. The figures are :—

	1897. Tons.		1898. Tons.
To Great Britain	136,356	..	81,892
,, Italy, &c.	37,921	..	4,598
	174,277		86,490

Bordeaux.—Imports and exports of sugar in 1897 and 1898 in tons :—

Imports. 1897.	Imports. 1898.		Exports. 1897.	Exports. 1898.
14,892	12,902	....	3,996	3,594

GERMANY.

Hamburg.—Total export of sugar for three years (in sacks of 100 kilos.) :—

1896.		1897.		1898.
13,929,500	..	9,398,500	..	9,765,000

Bremen.—Imports and exports of sugar for 1898, in metric tons :—

	Imports.		Exports.
Raw	39,188	..	39,287
Refined	15,307	..	11,346

The value of sugar exported to the United Kingdom in 1898 was M. 5,440,806, equal to about £272,000.

AUSTRIA-HUNGARY.

Trieste.—Exports of sugar for two years in metric tons :—

	1897.		1898.
Turkey	54,070	..	63,430
Greece	9,760	..	8,840
Italy	800	..	8,100
Austria-Hungary	3,100	..	3,140
Egypt	3,430	..	2,200
Bulgaria	3,060	..	3,340
Roumania	290	..	300
Gibraltar	160	..	240
Tunis and Tripoli	3,500	..	1,650
British India	33,120	..	30,800
Montenegro	160	..	200
Malta, Red Sea, Zanzibar and Persian Gulf	4,360	..	4,050
Switzerland (*via* Venice)	——	..	120
Great Britain	80	..	450
Japan and China	170	..	430
Other countries (by land) ..	730	..	870
	116,790		128,160

Fiume.—Export of sugar for two years in metric tons:—

	1897.		1898.
Raw	47,000	..	60,000
Refined..	10,000	..	12,000
	57,000		72,000

The value of the raw sugar exported to Great Britain in 1898 was £92,000; that of the sugar sent to India, £250,000.

Denmark.

The production of beet sugar for six years is given as follows, in tons:—

1893.	1894.	1895.	1896.	1897.	1898.
27,235	37,410	44,400	44,152	48,344	35,636

Imports of sugar in 1898 were, in metric tons:—

Great Britain.	Hamburg.	Germany.
8,700	2,700	5,500

Norway.

Imports of sugar and molasses for two years:—

	1897.		1898.	
	Tons.	£	Tons.	£
Sugar	25,810	368,226	29,568	414,530
Syrup	11,602	66,083	10,773	61,403

Sweden.

Imports of sugar and molasses for two years:—

	1897. Tons.		1898. Tons.
Sugar, refined	221	....	239
,, unrefined	822	....	269
Molasses	13,167	....	16,683

Italy.

Leghorn.—Imports of sugar for two years:—

1897.		1898.	
Tons.	£	Tons.	£
682	7,771	550	6,250

Nearly all of this came from Great Britain.

Spain.

The Consular report does not give quantities, but only values. Value in sterling of imports of sugar for three years:—

	1896. £	1897. £	1898. £
Cuba	263,000	89,000	33,000
Porto Rico	333,000	371,000	92,000
Philippines	65,000	51,000	5,400
Canaries	16,000	14,500	8,700
France	120	110	72
Other countries....	750	600	250
	677,870	526,210	139,422

Since the loss of the three first colonies there is naturally a great increase in the number and capacity of beetroot sugar factories in Spain, but with that short-sighted policy which is so characteristic, the Spanish Government has just increased the import duty on sugar machinery. The production of cane sugar at Motril and San Pedro de Alcántara is also developing satisfactorily.

Barcelona.—Sugar imports and values for two years:—

1897.			1898.	
Tons.	£		Tons.	£
16,304	346,566	....	5,965	119,127

Minorca.—The imports of sugar in 1898 were 202 tons value £3,720.

Malaga.—Imports of sugar for two years in metric tons:—

1897.	1898.
743	340

Kieff.

The British Consul states the district known as the South Western, viz., the provinces of Kieff, Podolia, and Volhynia, had in 1898 about 228,556 desiatines, equal to 628,529 acres of beet roots, the yield from which was calculated at 3,161,539 tons of beets, producing 359,531 tons of sugar. These figures are equivalent to about 57 per cent. of the area, 55 per cent. of the root crop, and 55·36 per cent. of the sugar produced, in all Russia. The following extract shows the method of control exercised by the Government and how it works out for an average-sized factory:—

"In their last return the Russian Society of Sugar Manufacturers give an example as to how the average factory producing 200,000 poods (3,226 tons) of sugar would dispose of it under Government control:—

	Quantity. Poods.	Quantity. Tons.
Allowance for home market, which each factory can immediately issue	60,000	968
Quantity for home market, which can only be issued or disposed of by permission of the excise authorities in a given proportion for each factory to complete the total quantity required for home consumption	96,320	1,553
"Inviolable reserve"	11,760	190
Free reserve for export or chargeable with double excise duty if put upon the home market	31,920	515

"The quantity of sugar fixed by the Minister of Finance for home consumption from the present campaign was 34,000,000 poods (548,387 tons), and to this must be added the 1,000,000 poods (16,129 tons) referred to below, or together 35,000,000 poods (564,516 tons). The individual allowance of 60,000 poods (968 tons) issuable without any restriction by each factory represents 14,580,000 poods (235,161 tons) (60,000 by 243 factories in operation), leaving 20,420,000 poods (329,355 tons) to be drawn from the quantity for the home market under the control of the excise authorities in order to make up the aforementioned quantity of 35,000,000 poods (564,516 tons) required for home consumption.

"There is, therefore, 9,286,474 poods (149,782 tons) of sugar available for export or otherwise from the total of 44,286,474 poods (714,298 tons) at disposal.

"Owing to the sharp and unexpected frost at the beginning of October, and the grave fears that the beetroot crop would be spoilt thereby, there was a sharp advance in the price of sugar upon the Kieff market, and the speculative element rapidly brought the price above the 'boundary price' of 4 r. 50 c. per pood or £29 7s. 6d. per ton (from September, 1898, to January, 1899), as fixed by the Minister of Finance. In order to counteract this speculation the Minister of Finance first authorised the issue of 1,000,000 poods (16,129 tons) of sugar from the 'inviolable reserve' to be placed upon the home market, and this measure not producing the desired result, a second ukase was issued restricting the export of the free reserve.

"If it is desired to thoroughly eradicate the speculative element in the price of sugar, there would need to be some more drastic measure than the fixing of 'boundary prices,' which, however well they may appear in theory, do not act as a controlling measure in practice. Since the introduction of the Government control and the fixing of 'boundary prices,' there has practically been an absence of the speculative business which was conspicuous before the present arrangement was adopted. No sooner, however, is there a scare as to the failure of the harvest or to the shortness of sugar supply, than the price is rushed up, and within the limit of the two weeks allowed by the Minister of Finance during which higher prices may rule before the 'boundary price regulations' come into force, large quantities of sugar may change hands, and at prices which practically nullify the controlling measures adopted by the Government.

"As an example of the speculation which took place it is interesting to note here that the week before the first ukase was issued by the Minister of Finance, the average price had gone up to 4 r. 73 c. per pood (£30 17s. 6d. per ton), or 23 c. per pood (£1 10s. per ton) beyond the fixed boundary price. The next week it was 4 r. 62 c. per pood (£30 3s. per ton) or still 12 c. (15s. 6d. per ton) in excess of the fixed margin, and even after the issue of the second ukase restricting the export of the free reserve the price was 4r. 72c. per pood (£30 16s. per ton), or 22c. (£1 8s. 6d.) per ton above the price fixed for September to January deliveries. During the week ending October 22, there were 37 sugar transactions on 'Change representing 823,750 poods (13,286 tons), and of these 15, representing 171,750 poods (2,770 tons) were speculative. The week following there were 20 transactions representing 342,750 poods (5,528 tons) of which 14, representing 220,000 poods (3,549 tons) were speculative."

TURKEY.

Beirut.—The quantities of sugar imported in 1897 and 1898 were, in bags of about 84 kilos :—

1897. Bags.	£		1898. Bags.	£
40,000	52,000	...	47,000	61,100

In 1898 about 30,000 bags came from Austria, 6,000 from Russia, and 6,000 from Belgium. The French imports, formerly almost the total, have fallen off heavily, and Egyptian crystallised has been largely replaced by Russian, which is cheaper than any of the kinds imported by about 3fr. per bag.

MOROCCO.

Tangier.—Imports of sugar for two years are given as :—

	1897. Tons.	£		1898. Tons.	£
Brown and crushed	126	2,194	....	99	1,768
Refined loaf, &c	697	12,218	....	876	15,470

The brown and cube sugars came from Austria, though they pass through Germany or London. Ordinary loaf sugar mainly from France, less than one-third from Belgium. At Alcazar the sugar is mostly French or Belgium.

Laraiche.—The imports and values were :—

1897. Tons.	£		1898. Tons.	£
3,488	60,224	....	2,347	42,879

Of this France sent, in 1898, 2,033 tons; Belgium 314 tons. Some of the French sugar came from Nantes, via Gibraltar, the great bulk from Marseilles.

Trebizond.—Imports and values of sugar for two years:—

	1897. Tons.	1897. £	1898. Tons.	1898. £
	3,205	42,070	4,330	74,380
In transit for Persia	1,032	16,515	684	10,945

Samsoun.—Imports and values of sugar for two years:—

1897. Tons.	1897. £	1898. Tons.	1898. £
2,245	44,920	3,057	43,540

Baghdad.—Imports and values of sugar during 1898:—

From Europe. Cases.	From Europe. Bags.	From Europe. £	From India. Bags.	From India. £
5,440	2,400	13,600	1,500	2,200

The value of the sugar in *bags* appears to be the same in both cases. The loaf sugar in cases came mainly from Marseilles.

Bussorah.—Imports and values of sugar for two years:—

1897. Cases.	1897. Bags.	1897. £	1898. Cases.	1898. Bags.	1898. £
51,196	24,854	107,771	42,076	26,735	105,196

The cases (fully refined sugar) came almost entirely from Marseilles.

N.B. The Bussorah figures also include the quantities for Baghdad.

Aleppo.—Quantities and values of sugar imported into Alexandretta:—

1897. Tons.	1897. £	1898. Tons.	1898. £
2,794	55,922	2,057	41,190

From Austria, which formerly had the monopoly, only 881 tons came (from Trieste) in 1898, and 500 tons from Antwerp.

Persia.

Ispahan.—Imports of sugar for three years:—

	1896–97.	1897–98.	1898–99.
Loaf in cases	5,556	7,111	12,183
Moist in bags	7,237	14,266	12,011

The Consul states:—"Sugar comes from France; it even reaches Teheran, and competes there with that made by the Belgian factory and also with Russian. It is more liked than either of these for its greater solubility and extra sweetness." This is easily understood, if, as is probable, it is the produce of Marseilles refineries, which use large quantities of cane sugar.

China.

Exports and values of sugar from following ports for two years:—

		1897. Tons.	1897. £		1898. Tons.	1898. £
Pakoi	brown and white*	1,523	10,860	..	5,025	45,983
Swatow	,, ,,	79,408	755,404	..	87,605	877,456
Chungking	brown	38½	307	..	70	616
Wuchow	brown	44	276	..	1,888	14,499
	white	202	2,399	..	1,581	15,910
	candy	..	..	..	7½	73
Amoy	brown	..	..	..	6,146	34,051
	white..	..	..	....	559	7,262
	candy	..	..	..	4,447	61,042

Imports and values of sugar to following ports for two years:—

			1897. Tons.		1897. £		1898. Tons.		1898. £
Wuchow	white	..	....	..	...	....	16	..	167
	candy	..	....	..	....	....	9	..	92
Amoy	candy	..	...	..	....	...	292	..	4,444
Chefoo	brown	..	11,515	..	....	....	8,386	..	....
	white	..	3,849	..	....	....	4,723	..	....
Kiukiang	all sorts	..	2,232	..	31,300	....	2,094	..	31,393
Foochow	white	..	221	..	3,574	....	16,27	..	25,300
Samshui	all sorts	..	81	..	1,007	....	236	..	2,781
Hankow	brown	..	24,032	..	203,217	....	325,761	..	162,230
	white	..	14,162	..	192,744	....	237,343	..	181,048
Shanghai	brown	..	44,085	..	407,474	..	27,470	..	253,429
	white	..	4,069	..	49,984	....	6,235	..	83,143
	refined	..	27,934	..	396,135	....	30,294	..	423,000

Japan.

The total imports and values of sugar for two years are given as:—

	1897. Tons.		1897. £		1898. Tons.		1898. £
Brown	73,965	..	488,462	....	96,420	..	748,648
White	116,859	..	1,522,384	....	163,342	..	2,149,399

More than half the quantity came, in 1898, from Hong-Kong as usual. The increase in that imported from Germany was 60 per cent. About £100,000 worth came from Java. About half the total value comes to Yokohama.

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* Sent to Japan and Northern China.

IMPORTS AND EXPORTS OF SUGAR (UNITED KINGDOM).

To end of June, 1898 and 1899.

IMPORTS.

Raw Sugars.	Quantities.		Values.	
	1898.	1899.	1898.	1899.
	Cwts.	Cwts.	£	£
Germany	3,125,947	2,242,911	1,394,131	1,111,042
Holland	138,998	247,891	56,639	114,728
Belgium	514,863	831,196	225,559	406,641
France	1,230,851	898,175	612,261	505,183
Java	60,708	92,762	33,110	53,918
Philippine Islands	262,790	161,149	104,098	73,872
Cuba and Porto Rico	5,180	1,320	2,908	1,000
Peru	662,134	246,177	329,209	135,099
Brazil	294,097	54,815	136,865	28,490
Mauritius	11,560	97,000	5,614	47,138
British East Indies	152,730	294,443	62,208	139,439
British W. Indies, British Guiana, & Brit. Honduras	614,783	636,485	370,173	475,266
Other Countries	361,420	514,397	172,986	287,708
Total Raw Sugars	7,436,061	6,318,721	3,505,761	3,379,524
Refined Sugars.				
Germany	5,625,051	5,973,830	3,403,810	3,705,805
Holland	1,111,324	1,076,552	711,418	710,301
Belgium	212,675	142,140	136,045	91,459
France	1,088,862	1,145,804	674,294	724,058
United States	5,699	4,839	6,619	5,195
Other Countries	34,481	20,239	20,345	12,006
Total Refined Sugars	8,078,092	8,363,404	4,952,531	5,248,824
Molasses	509,721	713,314	130,343	176,500
Total Imports	16,023,874	15,395,439	8,588,635	8,804,848

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden and Norway	50,366	35,899	29,333	22,652
Denmark	66,141	69,333	33,296	39,006
Holland	54,336	53,699	30,241	32,600
Belgium	7,888	7,173	4,390	4,362
Portugal, Azores, &c.	41,872	38,095	22,635	21,619
Italy	20,635	11,026	10,821	6,346
Other Countries	109,572	110,109	62,714	66,101
	350,810	325,334	193,430	192,686
Foreign & Colonial Sugars.				
Refined and Candy	88,032	80,770	54,161	51,750
Unrefined	285,084	152,589	155,587	91,134
Molasses	150,933	53,315	45,741	16,573
Total Exports	814,921	612,008	448,919	352,143

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1899. Tons.		1898. Tons.
Total Receipts, 1st Jan. to 20th July ..	1,051,890	..	838,124
Receipts of Refined ,, ,, ,, ..	1,602	..	15,476
Deliveries ,, ,, ,, ..	1,049,802	..	820,472
Consumption (4 Ports, Exports deducted) since 1st January	876,905	..	739,750
Importers' Stocks (4 Ports) July 19th ..	7,559	..	87,368
Total Stocks, July 26th	267,000	..	318,407
Stocks in Cuban Ports, July 26th ..	52,000	..	71,500
	1898.		1897.
Total Consumption for twelve months ..	2,047,344	..	2,071,413

CUBA.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, 1898 AND 1899.

(Tons of 2,240lbs.)	1898. Tons.		1899. Tons.
Exports	180,164	..	227,906
Stocks	86,679	..	60,990
	266,843		288,896
Local Consumption (six months)	24,700	..	19,800
	291,543		308,696
Stocks on the 1st January (old crop)	1,515	..	4,336
Receipts at Ports up to 30th June.. ..	290,028	..	304,360

JOAQUIN GUMA.

UNITED KINGDOM.

STATEMENT OF SIX MONTHS' IMPORTS, EXPORTS, AND CONSUMPTION FOR THREE YEARS.

	1899. Tons.		1898. Tons.		1897. Tons.
Stock, 1st January	76,930	..	90,030	..	139,623
Imports, Raw Sugar, Jan. 1st to June 30th	315,936	..	371,803	..	302,216
,, Refined, Jan. 1st to June 30th ..	418,170	..	403,905	..	372,880
,, Molasses, Jan. 1st to June 30th ..	35,666	..	25,486	..	28,897
	846,702		891,224		843,616
Stock, in 4 chief Ports, June 30th	63,000	..	83,000	..	88,000
	783,702		808,224		755,616
Exports (Foreign, and British Refined) ..	30,601	..	43,742	..	49,106
Apparent Consumption for Six months ..	753,101		764,482		706,510

Stocks of Sugar in Europe at uneven dates, July 1st to 22nd, compared with previous Years. In thousands of tons, to the nearest thousand.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	Total 1899.
61	356	336	230	69	1052

	1898.	1897.	1896.	1895.
Totals	1224	1163	1286	1313

Twelve Months' Consumption of Sugar in Europe for Three Years, ending June 30th, in thousands of tons.

Great Britain.	Germany	France.	Austria.	Holland, Belgium, &c.	Total 1898-99.	Total 1897-98.	Total 1896-97.
1637	775	562	366	450	3790	3760	3403

Estimated Crop of Beetroot Sugar on the Continent of Europe for the current Campaign, compared with the actual crop of the three previous Campaigns.

(From Licht's Monthly Circular.)

	1898-99.	1897-98.	1896-97.	1895-96.
	Tons.	Tons.	Tons.	Tons.
Germany	1,725,000	1,852,857	1,836,536	1,615,111
Austria	1,055,000	831,667	934,007	791,405
France	835,000	821,235	752,081	667,853
Russia	795,000	738,715	714,936	712,096
Belgium........	220,000	265,397	288,009	235,795
Holland........	155,000	125,658	174,206	106,829
Other Countries..	160,000	196,245	202,990	156,340
	4,945,000	4,831,774	4,902,765	4,285,429

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

As in June so in July, now coming to end, our market has been irregular and subject to continual fluctuations. The course of transactions and the movements of prices have practically been controlled from Paris, the operators there apparently holding the key of the situation, as they hold large stocks in Hamburg. The American demand for European sugar has not hitherto justified the expectations formerly held of its proximate revival, and the refiners there are said to believe that they will for some time continue to be independent of beet, having secured large supplies from Java, Egypt, &c. The market is, however, extremely sensitive, comparatively small operations of a few thousand tons being quite sufficient to cause immediate fluctuations of 3d. to 4d. per cwt. The prices successively paid for 88% beet during the month have been 10s. 8d., 10s. 4d., 10s. 7d., 10s. 9½d., 10s. 7¾d , and the month appears likely to close at about 10s. 9d. Stocks in Europe are about 172,000 tons, in America about 151,000 tons, for America and Europe together (including Cuba and cargoes afloat), about 193,000 tons below those of last year at this time. The future course of the market would for the present seem to depend on the power of the European operators to hold their stocks. It is yet far too early to say anything definite about the new crop, and prophets have not forgotten how they were deceived last year in respect to the Austrian production.

Cane sugar transactions continue very limited, prices on the whole are at present below those of last month, except for Madras jaggery, which is being more used by refiners.

The following quotations are in all cases for prompt delivery :—

			Last Month.
Porto Rico, fair to good Refining	11/0 to 12/0	against	11/6 to 12/6
Cuba Centrifugals, 97°/₀ polarization....	12/3 to 12/6	,,	12/9
Java, No. 14 to 15 D.S.	12/3 to 12/6	,,	13/0
British West India, fair brown	11/3	,,	11/6 to 11/9
Bahia, low to middling brown	10/3	,,	10/6
,, Nos. 8 and 9..	11/0 to 11/3	,,	11/3 to 11/6
Pernams, regular to superior Americanos.	11/3 to 11/6	,,	11/6 to 11/9
Madras Cane Jaggery	10/0	,,	10/0
Manila Taals	9/3 to 9/9	,,	9/3 to 9/6
French Crystals, No. 3, f.o.b.	12/1½	,,	12/3
Russian Crystals, c.i.f..	?	,,	?
German granulated, f.o.b.	12/4½	,,	12/3
Tate's Cubes..	15/10½	,,	16/1½
Beet, German and Austrian, 88%, f.o.b. ..	10/9	,,	10/9½

THE

INTERNATIONAL SUGAR JOURNAL.

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☞ All communications to be addressed to Edward Sutton, Office of *The Sugar Cane*, Manchester.

Advertisements from those desiring employment are inserted Free of Charge. All Advertisements to be sent *direct*.

☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

Omission.—In our last issue, page 396, line 24, after the words "was started," insert "in Persia."

We give, further on, tables, taken from a British Consular report, for quickly and conveniently reducing metric to imperial weights and measures, and *vice versa*. In consideration of the almost universal introduction of the metre and kilogram into all countries excepting the United Kingdom and North America, such tables may be found useful by many of our readers.

Shipments of sugar from Mauritius from 1st August, 1898, to 21st July, 1899, are reported as 183,372 metric tons, against 119,543 metric tons for the corresponding period of last season. Unfortunately the bubonic plague is gaining ground, and appears likely to extend to the plantations.

Exports from British Guiana from 1st January to 1st August:—Sugar, 36,697¼ tons; rum, 870,383 gallons; molasses, 4,054 casks; cocoa, 120,674 lbs.; against 50,043½ tons; 1,273,700 gallons, 1,468 casks, and 45,435 lbs. respectively for the like period last year.

The *Archief voor de Java Suiker-industrie* of 1st June gives the average production of sugar per hectare for the whole of the estates in 1898 as 10,087 kilograms, a figure that has never hitherto been

attained, and is equal to somewhat over 4 metric tons per acre. Five factories made over 13,000 kilos. of sugar per hectare, one as much as 14,021 kilos., equal to $5\frac{3}{5}$ metric tons per acre.

A summary of the Daira Sanieh (Egypt) Report for 1898, will be found in the present number. We understand the results obtained at the new Baliana factory of the Egyptian Sugar and Land Company, Ltd., have been satisfactory. The machinery in this factory is of the newest description, and the mode of working somewhat different to that adopted in any other Egyptian factory.

In France the export Countries for the coming campaign (1st September to 31st August) have been fixed at:—

	fr.	
1st category	2·76	per 100 kilos.
2nd ,, ...	3·16	,,
3rd ,, ...	3·55	,,

The full limits allowed by the law of 7th April, 1897, were fr. 3·50, fr. 4·00, and fr. 4·50 respectively, and these rates were paid for the campaign 1897-98, but as they resulted in a loss to the Treasury, only 69·129 per cent. of them was allowed during the past season, 1898-99. The rates for 1899-1900 are equal to 79·01 per cent. of the maximum legal premiums.

The following, taken from an exchange, may be news to some of our readers:—

"A particularly interesting stall at Earl's Court Exhibition, and one over which great expense has been incurred, is that devoted to Glebe Sugars. The real bonâ fide sugar-canes are there shown as they grow in the natural state in our colonies. Indeed, the canes are growing in the very earth in which they were shipped from Trinidad, &c., and as the British public is, for the most part, unfamiliar with these growing canes, the sight is a novel and interesting one. The products of the Glebe Sugar Company are guaranteed to be absolutely pure, and special care is exercised in enclosing the sugars in strong packages so that they may reach customers in the pure and clean state in which they leave the refinery."

The Glebe Sugar Refining Co. is well known for supplying guaranteed *pure cane* sugar.

We have received copies of the following testimonials to the efficacious working of the Grossé process:—

From France:—"Under equal conditions, the results are always in favour of the Grossé process; the yield is regular and can be determined beforehand, while that obtained by reboiling and tank storage is always uncertain and fluctuating."

From London:—"There is no doubt as to its complete success."

Full particulars on application to Mr. G. Stade (see advertisement on page x.)

At the examination of the City and Guilds of London Institute, held in April this year, Mr. David Templeton, chemist to "The Brewers' Sugar Co., Ltd.," Greenock, obtained in the division "Sugar Manufacture," a 1st class Honours Certificate, being the highest award that can be gained.

WEST INDIES.

We omitted last month to record the receipt of the first number of "The West Indian Bulletin,"* the official journal of the Imperial Agricultural Department for the West Indies, the establishment of which, under the direction of Dr. D. Morris, G.M.G., M.A., D.Sc., F.L.S., Commissioner of the Department, we announced in *The Sugar Cane* for September 1898. We are informed, in a few introductory remarks, that it is proposed to issue this publication occasionally, and that it will contain notes of the operations of the Department, and information respecting the best means for improving the cultivation and preparation of tropical produce.

To begin with, it is a pleasure to read such a well got up and in every way creditable publication, and it cannot be doubted that the dissemination of information in the mode chosen will be most valuable in the furtherance of the interests of the West Indies and British Guiana planters, and again, while it is proposed to issue the Bulletin free to residents in the West Indies who will send their names and addresses to the nearest Botanic Station, the charge for the present double number, of over 140 pages, is only sixpence, so that the extremely moderate price will bring it within the reach of all who are in any

*The West India Bulletin. The Journal of the Imperial Agricultural Department for the West Indies. Vol. I., No. 1. Double Number, price 6d. London Agents: Dulan & Co., 57, Soho Square, W.

way interested. This first number is almost entirely devoted to a report of the Agricultural Conference held in Barbados last January, an account of which, together with a summary of Dr. Morris's opening address, we gave in our number for February last. We have also given on pages 154 to 156 and 189, a tolerably large portion of the address of Mr. J. H. Hart, Superintendent of the Royal Botanic Gardens, Trinidad, on "Improvements in Tropical Agriculture." Other most interesting papers, together with the discussions which followed, are reproduced in full in the Bulletin, and we propose to summarise these as succinctly as possible, while advising every one concerned in the solution of the important questions on which they treat to procure the Bulletin itself.

The first paper read was by Prof. D'Albuquerque, M.A., F.I.C., F.C.S., now appointed honorary Analytical and Agricultural Chemist for the Windward Islands, and was devoted to "Sugar Cane Manurial Experiments." Although he expressed some diffidence in dealing with the subject, those of our readers who have perused the annual reports on the experiments at Dodd's or even the summaries of them which have so frequently appeared in *The Sugar Cane*, will feel no doubt as to his qualification for introducing the discussion on this question. The points touched on by Prof. D'Albuquerque were :—(*a.*) The choice of locality; (*b.*) the size and number of plots; (*c.*) the variety of cane to be used; (*d.*) the methods of applying manures; (*e.*) the selection of cane samples for crushing. It will be seen that these matters are too exclusively technical for general readers, but the discussion which arose, and which would probably have been much prolonged had time allowed, sufficiently showed the interest taken in the subject. Professor Harrison summed up the position; stating that it is better not to use the "Bourbon" variety for experimenting, but to use selected seedling varieties; that the principal point to be ascertained is the amount of nitrogen that the canes will take up, and that we already know the amount of phosphates and potash to apply, the principal difficulty being with the nitrogen, the constituent on the correct application of which the crop immediately depends. The reason, given by Mr. Francis Watts, for the unsuitability of the Bourbon for manurial experiments is that it is attacked by a variety of diseases, so that a much larger proportion of this is lost than of certain other varieties and hence the results of the experiments are vitiated. A peculiarity connected with too liberal a use of superphosphates was mentioned by Professor Harrison, viz., that the very

manure which is necessary to obtain a good yield decreases the yield if applied in excessive quantities.

The next paper was read by Mr. J. R. Bovell, F.L.S., F.C.S., the subject being "Field treatment of the Diseases of the Sugar Cane in the West Indies."

The paper detailed in a concise form the facts respecting the severe outbreak of disease among the West Indian canes, notably the Bourbon (or Otaheite), which at one time was the variety almost exclusively cultivated in the Islands and British Guiana, and has now in Barbados been largely replaced by the Caledonian Queen, Queensland Creole, &c. Mr. Bovell considered that the two great enemies of the cane are the moth borer (*Diatræa saccharalis*) and the rind fungus (*Trichosphæria sacchari*), together with that phase of the latter disease* known as the root fungus (*Colletotrichum falcatum.*) The treatment recommended by Mr. Bovell is as follows :—

(1.) That all borer plants (*i.e.*, plants bored by the moth borer) should be rejected, for even if they are soaked in some disinfecting solution, it is not possible in every instance for this to penetrate the narrow channels containing the larvæ and pupæ, owing to the débris and air contained therein.

(2.) That all plants should be soaked for twelve hours in lime water, containing one gallon of lime to 100 gallons of water—or in a dilute solution of Jeyes' fluid, or a solution of carbolic acid of one pint to 100 gallons of water, so that any adhering eggs or insects may be destroyed.

(3.) That careful inspection of the growing canes be made periodically, and whenever the presence of the larvæ is noticed by the appearance of what are locally known as "dead-hearts," that all canes so affected be cut out and burned. If the estate-mill be at work they may be passed between the rollers and then thrown on the compost heaps.

(4.) That as soon as practicable after a field is reaped, all dried and decaying canes be collected and burned, passing any that contain juice through the mill first.

(5.) That at the time of the year when the moth borer is most prevalent, lighted lanterns be suspended over vessels containing some viscous liquid, such as molasses and water.

* This assumption is denied by Professor Went, formerly of Java, now Botanical Professor at the University of Utrecht.

As regards the other and most mischievous pest or pests, the rind fungus and the root fungus, the destruction wrought by which "was at one time so great that legislative action was proposed with the object of carrying out uniform and effectual remedial measures," Mr. Bovell stated that the following methods had apparently proved effectual for combating the disease in Barbados, and therefore suggested them for general adoption:—

(*a*) Only canes of a fungus-resisting variety should be planted.

(*b*) No plant should be taken from any stool having the appearance of being affected with disease.

(*c*) All plants should be soaked in water containing lime, carbolic acid, or Jeyes' fluid.

(*d*) Any plants that fail to germinate should be dug up and destroyed.

(*e*) Up to the time that it is possible for the labourers to pass between the rows, all canes having rind fungus should be cut out, and where they are affected with the root fungus the stool should be dug out, and all infected matter burned.

(*f*) All spots of land affected with the root fungus should be planted with some other crop for at least a year, and not merely planted with some other variety of the sugar cane, as is done in some instances in Barbados.

(*g*) After all sound canes have been taken from a field all rotten and diseased canes should be collected and burnt. When canes are too full of juice to burn readily they should be crushed, the juice therefrom heated to boiling, and the megass burned.

Of the hardy varieties of cane which are "fairly fungus resisting," Mr. Bovell names the Caledonian Queen, Rappoe, Queensland Creole, Naga B., White Transparent, and a seedling, "B. No. 147," which, "so far as he knows," is free from the two fungoid diseases, and its yield in available sugar per acre is larger than that of the others, that is, judging from the series of experiments at Dodds, the results of which are as below, but we all know that no experiments, even ranging over a period of years, can be decisive with regard to estate cultivation in the open fields and what might be possible under normal conditions.

Available Sugar per Acre, in lbs.

B. 147.		Caledonian Queen.		Rappoe.		Naga B.		White Transparent.		Bourbon.
7,190	..	6,137	..	5,929	..	5,894	..	5,275	..	5,210

In the discussion which ensued, Mr. Bovell, in reply to questions from Dr. Morris, said :—

"I believe that fully 90 per cent. of the canes attacked by rind fungus had already been attacked by the moth-borer, but I may add that I have seen the rind fungus on some canes that had not been attacked by the borer. I attribute the partial disappearance, at present, of the fungus in the island to the substitution of selected seeding canes in place of the Bourbon, and to the greater care taken in selecting healthy types for planting, also to the more general practice of cutting out and burning diseased canes as suggested by the President."

One of the questions bore on the statement, now generally accepted, that the entrance of the rind fungus is facilitated by the perforations made by the moth-borer.

Some discussion also took place on the question of whether heavy rainfall would effect the disappearance of the rind fungus, and the theory (which we believe to be utterly without foundation) that disease is due to the action of artificial manures was referred to by Mr. Watts, who instanced the case of Montserrat, where the cane-fields are in a frightful state of disease, and yet no artificial manure has been used. All that we have heard and read on this subject has tended to establish the probability that a proper use of artificial manure would so strengthen the plant as to enable it to resist disease more effectually. The entire study of disease points to asthenia, from whatever cause, as the primary condition of susceptibility.

(To be continued.)

Dr. Degener, who has been making himself acquainted with the jam and similar industries in Great Britain, calculates that the consumption per head per day in the United Kingdom, either in the form of jam or marmalade, amounts to 17 grammes (somewhat over half an ounce), which, he says, equals in value two spoonsful of tea. This is a good example of the curious minutiæ of which our German cousins are so fond.

GERMANY.

Jam and Marmalade Manufacture.

On re-perusing the articles by Dr. Degener, translation of one of which was given in our last number, we find that an earlier portion, in which a description is given of the way in which jams and preserves are made, is not without considerable interest, and should really have been given before the other. Perhaps it is not too late to repair the omission, and we therefore present our readers with a translation of Dr. Degener's remarks on

The Manufacture of Jams and Marmalades.

Jams are manufactured according to two methods, of which the one we shall consider first is the ordinary English mode. Marmalades, *i.e.*, orange and lemon preparations exclusively, are made in a slightly different way.

The stalks are removed from the fruit, in many cases by a special machine, and the fruit is boiled in what is known as a "boiler," a large copper pan, until the mass becomes quite soft, it then goes through a straining-machine, in which the fine fruit pulps and juices are separated from the pips, stones, rind, stalk residues, etc. The preparation thus cleansed is now brought to the desired consistency in "jacket pans," small copper pans with double bottoms, working at a pressure of four atmospheres, which are also provided with stirrers. This boiling down naturally effects at the same time a complete sterilisation, so that the concentrated fruit juices will keep for a lengthened period.

As it is impossible, during the short time of the fruit harvest, to work up all the paste into finished jam, it is stocked, with the exception of a certain quantity, the preparation of which is completed in vessels holding about 12 kilos. These vessels are preferably made of stoneware. Naturally they should be sterilised before being used, but I do not know whether this is done in England. It is very often sufficient for sterilisation to fill the fruit paste hot into the vessels. Owing, however, to the power of resistance of many micro-organisms or their stable forms, sterilisation is advisable. Mr. Mathieson thinks that a considerable portion of the success of the English manufacturer is due to the way in which the fruit paste is kept unchanged. On this point, however, we have no information. The latest researches

into bacteriology will not be without use as regards the German industry, and I hope soon to be able to report upon them. The fruit paste, worked up either directly or after a more or less lengthened storage, is mixed, for the preparation of jam, with the necessary quantity of sugar. According to Marx, the quantities in England are 56 parts pure sugar, which, it may be mentioned, need not be completely refined, to 60 parts of fruit. It is advisable to sterilise the sugar previously by drying at a sufficient temperature.

In the German receipts the proportion between fruit and sugar varies greatly; as a matter of fact no constant figure can be given, as the addition of sugar depends entirely on the amount of acid and of the substances which can be gelatinised. The real art of jam boiling, in which lies the secret of the English factories, consists in bringing about the proper harmony between acidity, sweetness, and flavour, and this art has to be acquired, so that every factory must have a staff of experienced men. This is quite natural, as the production of jams is a process capable of progressive improvement, and just as other comestibles of definite origin (cheese, beer, ham) have a certain reputation, which makes them sought after and which renders them easily saleable, so it ought to be with the fruit industry. From this point of view the sugar industry is really behindhand, for pure sugar of constant quality is with us as yet unknown.

In the case of many preserves prepared in this manner, sugar crystallises out after a time, often separating in the form of a hard crust. This is no disadvantage as far as taste, digestibility, and food value are concerned, but it goes against what the consumer is accustomed to, which after all has to be considered. Such jams are no longer capable of being properly spread. With ordinary fruit jams, to which no cane sugar has been added, this does not matter, but in the contrary case it is necessary to prevent crystallisation, and this is effected by adding to the finished jams about ten per cent. of their weight of capillaire syrup, that is, of incompletely inverted starch, *i.e.*, dextrine. The English call it "killing the corn." It may be incidentally remarked that the capillaire syrup produced in Europe, especially in Germany, cannot be used for this, it has to be imported from America. Mr. Mathieson has found that German syrup, even when it is as clear as water, injures the quality of the jam. This seems to be due partly to the raw material—in one case maize, in the other potatoes—and partly to the method of inversion—hydrochloric or oxalic acid against sulphuric acid—and finally to the large amount of sulphurous acid

present in our product. As the addition of capillaire syrup will also be necessary here, the manufacturers of this article will do well to produce a preparation similar to the American syrup. I do not know whether the inversion is now effected in America by means of oxalic or hydrochloric acid. Some fifteen years ago inversion by means of the former acid was introduced at Buffalo.

As there are in Germany no theoretically taught men for superintending such operations, the substitution of hydrochloric or oxalic acid for sulphuric acid would at first be expensive and troublesome, and it would be advisable for the State laboratories in Berlin, &c., to work this process out. It does not appear to be practicable at present to replace the capillaire syrup by anything else. Probably something may be done with some other cheap, suitable, tasteless, odourless, and intumescible substance of vegetable origin, hence not gelatine, if the starch industry should decline to meet the requirements of the jam industry. However, I shall have to refer again to the capillaire syrup. One more remark may be made about the preparation of jam by heating. It permits the use of unripe fruit, and this is of great moment to the English fruit industry. According to the very pertinent statements of Dr. Gerlich in Section 21 of the Communications of the German Agricultural Society for 1898, the English fruit industry cannot exist without the importation of foreign fruit. In addition to oranges, which come from Spain and Italy, England imports fruit for working up in its factories from Belgium, Holland, France, and Germany.

Imports of Apples into England.

From	1893. Bushels.*	1894. Bushels.	1895. Bushels.	1896. Bushels.	1897. Bushels.
Germany ..	60,000	50,000	27,000	14,000	24,000
Holland....	588,000	505,000	243,000	52,000	387,000
Belgium ...	1,000,000	1,160,000	581,000	311,000	383,000
France ...	564,000	510,000	185,000	217,000	173,000
America ..	472,000	1,442,000	984,000	2,614,000	1,808,000
Canada ...	483,000	1,082,000	1,007,000	2,624,000	1,021,000
Tasmania..	121,000	135,000	122,000	152,000	135,000
Spain	1,000	1,700	342	3,262	59,000
Portugal ..	95,000	65,000	91,000	146,000	146,000
Totals ..	3,460,000	4,969,000	3,292,000	6,177,000	4,120,000

* One Bushel = 36·3487 litres.

Imports of Pears into England.

From	1893. Bushels.	1894. Bushels.	1895. Bushels.	1896. Bushels.	1897. Bushels.
Germany ..	39,000 ..	18,000 ..	8,000 ..	2,500 ..	23,000
Holland ..	54,000 ..	103,000 ..	43,000 ..	48,000 ..	134,000
Belgium ..	373,000 ..	693,000 ..	116,000 ..	143,000 ..	529,000
France	430,000 ..	445,000 ..	189,000 ..	239,000 ..	269,000
America ..	3,700 ..	32,000 ..	41,000 ..	38,000 ..	87,000
Totals .	899,700	1,291,000	397,000	470,500	1,042,000

Imports of other (unclassed) Fruits into England.

From	1893. Bushels.	1894. Bushels.	1895. Bushels.	1896. Bushels.	1897. Bushels.
Germany	76,000 ..	132,000 ..	192,000 ..	13,000 ..	110,000
France	106,000 ..	159,000 ..	80,000	90,000 ..	133,000
Holland	149,000 ..	249,000 ..	151,000	. 131,000 ..	148,000
Spain	351,000	. 351,000 .	371,000 ..	425,000 ..	534,000
Canary Islands	252,000 ..	216,000 ..	315,000 ..	485,000 ..	569,000
Totals	934,000	1,107,000	1,109,000	1,144,000	1,494,000

Imports of Prepared Fruit into England.

From	1893. Cwts.	1894. Cwts.	1895. Cwts.	1896. Cwts.	1897. Cwts.
France	30,000 ..	30,000 ..	44,339 ..	32,616 ..	36,589
Spain	19,661 ..	19,286 ..	26,500 ..	64,385 ..	70,045
Italy	181,071 ..	236,607 ..	178,500 ..	195,036 ..	205,929
Greece	38,920 ..	3,482 ..	6,786 ..	9,491 ..	19,411
United States..	178,196 ..	27,160 ..	32,482 ..	33,787 ..	49,920
Pacific Coast..	555,759 ..	28,688 ..	54,839 ..	99,188 ..	89,375
Totals .. .	1,003,607	345,223	343,446	434,503	470,269

Of these imports Canada sends a rapidly increasing share. From these figures it follows that England is dependent, as regards the jam industry, upon imported material. Not all kinds of fruits, however. can stand the voyage to England, if they are sent in ripe condition during the hot season of the year. With suitable packing and cold air arrangements, soft fruits, such as plums, greengages, strawberries, peaches, apricots, and raspberries might be brought into England in such condition that their quality, flavour, and appearance would remain unchanged, and even table fruit might be imported in this way from Germany. But though I am convinced that there is still a remunerative opening for the German fruit growers in this direction, and that the export of ripe aromatic table fruit—not merely apples

and pears—would beneficially influence and strengthen the German fruit industry. The import of the more delicate fruits already mentioned, viz., plums, strawberries, raspberries, currants, gooseberries, peaches, and apricots, in the way described would add so much to their cost that their use in the preserving industry would leave no profits, especially as freight, carriage, insurance, and intermediary profits would have to be added.

The English jam industry therefore depends largely upon unripe foreign fruit. This circumstance only permits the preparation of the jam by heat, for the cellular substance of the unripe fruit is on the one hand too difficult of digestion if not boiled, and on the other hand contains fermenting substances which bring about serious disturbances in the digestive organs. To soften the former and to kill the latter high temperatures are necessary. According to Mr. Mathieson's statements, vacuum pans have not been generally adopted in the preserving industry in England. I attribute this mainly to the fact that for many green fruits the temperature so obtained is not sufficiently high.

Further, many fruits imported in an unripe condition do not posses the full flavour, and finally, the pips, stone, skin, &c., form a much larger percentage in the unripe than in the ripe fruit. As a compensation it must be remembered that the heating effects a complete sterilisation. To speak more precisely, only the importation of ripe apples will be profitable, because with them it is less a question of the flavour and because they will keep sufficiently well, while ripe berries and grapes are easily injured.

The second way of preparing jams is the cold method, which, however, is at present apparently little used. Heat is not entirely excluded, but is only used to a limited extent. There is no boiling of the fruit; it is mechanically disintegrated (for which purpose it must naturally be as ripe as possible), then passed through a machine, and afterwards mixed with sugar. A temperature of 30° to 40° C. is maintained, which effects a good and quick solution of the sugar and results in the formation of a gelatinous mass. An addition of capillaire syrup would be advisable, to prevent crystallisation. If we are to believe the books, however, the procedure is different. The product is heated for a longer or shorter time at 100° C., so as to obtain complete sterilisation. In this way sterilisation certainly does take place, but it is doubtful whether the proper consistency will be obtained in all cases without removing some of the water, and hence without longer

continuous boiling, especially with very watery fruit, with such qualities of sugar as can be used to produce a harmonious flavour. Consequently boiling cannot in many cases be dispensed with, and the jams made in the cold way would therefore not always compare favourably with those made in the English way. This method is naturally applicable only to the use of perfectly ripe fruit; unripe fruit would in many cases yield an unwholesome product. With stone fruit especially, the separation of the stone from the flesh without heat is difficult and troublesome in the case of unripe fruit, and therefore expensive. It is evident, then, that this method cannot be of any value to the English industry, as the instability of ripe fruit, especially of the stone and berry sorts, which produce the best jams, renders it useless. Where the cold method is applicable, very fine flavoured products are obtained. A very large portion of the flavouring substance can be saved (and this is a very important feature of the English method) if the boiling is done in a vacuum apparatus, the aromatic substances being separated from the vapours passing over.

Dr. Christ, of Berlin, has named two suitable methods, of which one has not yet been made public, and consequently I cannot deal with it, but it appears to me to be specially worthy of notice.

Naturally the flavour thus obtained is not identical with that of the fresh fruit, and indeed differs from it in many cases, especially with strawberries, peaches, grapes, and even raspberries. Christ's method must however be considered as a material advance. I believe that the technical procedure in jam manufacture is capable of essential improvement, and I hope soon to be able to report upon such. The principal points to be kept in view must be:—

1. The use of none but ripe fruits.
2. The preservation of the whole of the flavour.
3. The avoidance of heating above the temperature at which albumen coagulates or the flavour becomes dissipated.
4. A rational application of the by-products.
5. The conservation of the article, by taking advantage of the most recent researches in bacteriology.

The preparation of orange jams, the marmalade *par excellence*, also called orange marmalade may here be mentioned. The preparation of lemon marmalade is similar. In the making of these products, not only the juice of the fruit and the internal substance but also the peel, which may be previously cut off, are used. The peel is cut into thin strips and then boiled, by which the pectin substances present are

changed into a jelly, a fact already noticed by Fremy and others. The mass thus obtained is eventually mixed with the real juice and by preference boiled along with it, then passed through a straining machine, and is finished after the addition of sugar.

These marmalades have a somewhat bitter flavour and are therefore more suitable to men's taste. It may be pointed out here that the gelatinising substances are by no means always present as such in fruit. They result partly from the action of vegetable acids upon certain cellular constituents at about 30° to 40° C., which temperature is not injurious to the flavouring substances, but their formation is also partly due to fermentive organisms, which are probably closely allied to leuconostoc. Investigations on this subject as well as on the application of other intumescible vegetable substances will be of practical value to the fruit industry.

BARBADOS SUGAR.

From the *Echo*, 17th August, 1899.

The reviving taste for the old-fashioned cane sugar of the West Indies is becoming a marked feature in the trade; and as this taste or fashion develops it will tend to mitigate, by inducing larger imports of Barbados and other natural cane sugars, the inconvenience so long felt by the public through the scarcity over here of the old-fashioned and once popular sugar of Barbados and the West Indies. I have heard—a correspondent writes—of one planter recently getting £15 a ton in London for some of the soft moist sugar of Barbados. This sugar, made in the old-fashioned way, and consequently retaining the natural sweetness and flavour of the sugar cane, was the sugar referred to by Addison. "The Fruits of Portugal," he writes in the *Spectator* "are sweetened by the products of Barbados," and Pepys, in his diary, speaks of the arrival of a cargo of this sugar as a present for the king. Even the insect would take to this soft, sweet sugar, for the bee masters are ordering it for their bees. But what is more important is to observe that the public back their taste for this "most sugary of all sugars" by paying, at the present time, a higher price for Barbados soft moist sugars than for the finest-looking crushed sugars of France and Germany. Should this turn of taste continue, Barbados may be able to snap her fingers at beet sugar and its bounties.

QUEENSLAND.

Results of Working in Central Factories.

The annual reports for the year 1898-99 of the Central Factories established by the aid of Government loans, and now beginning to appear in the Mackay *Sugar Journal*, have, in view of the contemplated setting-up of somewhat similar factories in the West Indies, a special interest for the sugar-growers of those islands. We therefore propose to give some of the salient facts, as indeed has been our custom from time to time.

The Mulgrave Central Mill Co.'s report contains (among others) the following particulars of manufacture. This mill made a profit of £4,107, after allowing for Government interest up to 31st December, 1898. The plant being insufficient for the quantity of cane expected to be available for 1899, a further loan of £10,000 was asked for from the Government, and granted. The mill commenced work on the 15th July, 1898, and closed on the 25th January last.

	1896-97.			1897-98.			1898-99.		
	Tons.			Tons.			Tons.		
Quantity of cane crushed..	13,753			17,408			37,552		
,, sugar made	1,444			1,716			4,164		
	Tons	Cwt.	Qrs.	Tons	Cwt.	Qrs.	Tons	Cwt.	Qrs.
Quantity of cane per ton sugar ..	9	10	2	10	3	0	9	0	1
,, ,, ,, ,, (88%)	9	4	2	9	11	0	8	12	0
,, firewood to 1 ton sugar	2	5	2	2	2	0	1	6	3
Average net test of all sugars ..	90·72			93·25			*91·66		
	£	s.	d.	£	s.	d.	£	s.	d.
Cost of cane per ton at mill	0	10	0	0	10	2	0	10	3
,, sugar per ton†	9	18	4	9	17	9	7	13	9
Price obtained for sugar (88%) ..	9	12	6	8	0	0	8	0	0
Average profit per ton	—			—			0	19	9
,, loss per ton	0	0	8	0	11	4	—		

The Nerang River Sugar Company's report states that they made a new departure in the season under review, by making white sugar for consumption instead of raw sugar for the Colonial Sugar Refining Company, and consider the result satisfactory. Crushing was commenced on the 23rd July and completed on the 22nd December, but the centrifugals were at work for about two months of the current year, drying the No. 3 sugar.

* Returns incomplete. † Not including depreciation.

	Tons.		
Quantity of cane crushed	12,706		
,, sugar made	1,253		
	£	s.	d.
Average cost of cane per ton	0	10	10
Cost of manufacture per ton of sugar	9	8	5
Average price obtained per ton	10	8	1½
,, profit per ton (not including interest on loan)	0	19	8½

The total profit was £1,234 5s. 11d., from which has to be deducted the year's interest, leaving a net profit of £142 5s. 11d. At the beginning of the year the arrears of loan repayment and interest amounted to £3,310, now reduced (31st December, 1898,) to £3,168.

The Mossman Central Mill Company commenced crushing on the 14th July, and finished on the 5th December, 1898. The low price of sugar and the defective supply of cane resulted in an unsatisfactory balance sheet.

	1897.			1898.		
	Tons	Cwt.	Qrs.	Tons	Cwt.	Qrs.
Quantity of cane crushed.. ..	27,905	0	0 ..	33,364	0	0
,, sugar made..	2,778	0	0 ..	3,780	4	0
,, cane per ton sugar	9	16	0 ..	8	16	1⅗
,, sugar made (88%)..	2,965	0	0 ..	4,001	8	0
,, fuel per ton of sugar (88%)	1	4	1 ..	1	8	1⅗
	I.	II.	III.	I.	II.	III.
Average net test of sugar	95	89	72·25 ..	96·07	90·52	80·0
	£	s.	d.	£	s.	d.
Cost of sugar per ton, all expenses, including Government interest, but not depreciation	9	3	0⅞	7	7	8½
Government interest paid	738	11	10	2,149	8	7
Depreciation of machinery, &c., charged	——		....	2,042	18	0

(To be continued.)

It is reported that the diffusion plant on the Caracas estate (Terry Brothers) at Cienfuegos, (Cuba) has worked so successfully this last season that a further large plant has been ordered in France, and that the mill system will be entirely abandoned on this estate.

TECHNICAL EXAMINATIONS IN CONNECTION WITH THE SUGAR INDUSTRY.

We wonder how many of our readers in the United Kingdom are aware of the existence of such examinations as these in connection with the City and Guilds of London Institute? To judge from the experience of the writer, the knowledge that it is possible to pass such an examination in any part of the British Isles must be confined to exceedingly few, and so we shall be doing a simple duty in calling attention to these, and stating that full particulars can be had on application to the Assistant Secretary, City and Guilds of London Institute, Gresham College, London. The following, which is a reproduction of the question paper on sugar matters in connection with the Spring examinations this year, will serve to show that a considerable acquaintance with the processes, chemistry, and general technology of sugar manufacture is required to pass the honours grade, the first class certificate of which was obtained this year by Mr. D. Templeton, Chemist to The Brewers' Sugar Co., Ltd., Greenock.

8.—SUGAR MANUFACTURE.

Wednesday, April, 26th, 7 to 10.

INSTRUCTIONS.

The Candidate must confine himself to one grade only, the Ordinary or Honours, and must state at the top of his paper of answers which grade he has selected. He must *not* answer questions in more than one grade,

If he has already passed in this subject, in the first class of the Ordinary Grade, he must select his questions from those of the Honours Grade.

The number of the question must be placed before the answer in the worked paper.

Three hours allowed for this paper.

The maximum number of marks obtainable is affixed to each question.

N.B.—Candidates are cautioned to avoid giving in their answers to the following questions any particulars of processes used in the works in which they are employed which are not matters of public knowledge.

ORDINARY GRADE.

1. What tests should be employed to indicate when the operation of washing char is satisfactorily accomplished? (*25 marks.*)

2. In what way may dextrin be prepared, and what are its principal properties? (*25.*)

3. Give the composition of a good sample of sugar cane and sugar beet. (*20.*)

4. In what important point does dextrose differ from levulose? (*25.*)

5. State how invert sugar can be determined by weight in a sample of brewer's saccharum. (*30.*)

6. Give a sketch of a Taylor (bag) filter, and state how it should be worked. (*40.*)

7. How is beetroot pulp preserved for use as food for cattle? (*30.*)

8. How can the loss of actual cane sugar during its passage through refinery be ascertained? (*40.*)

9. Calculate the percentage of C H and O in cane sugar and glucose. (*30.*)

HONOURS GRADE.

1. Give a short account of the process known as crystallization in motion, and state its advantages. (*30 marks.*)

2. Describe the Steffen process for recovering sugar from beet molasses. (*35.*)

3. How can the composition of a sample of golden syrup containing liquid glucose made from starch be ascertained? (*40.*)

4. If it was found that the products of a refinery were being contaminated with iron, how could this be obviated? (*30.*)

5. Give a rough plan showing the arrangement of plant in a small cane sugar factory, marking the apparatus in the order in which they are used. (*35.*)

6. How can the impurities from the surface of 92 per cent. net beet sugar be removed preparatory to refining in the usual way? Give two methods, and state the approximate yield per cent. of purified sugar and molasses. (*35.*)

7. What is the effect of raising the temperature on the polarisation of a solution of invert sugar, and to what constituent is it due? (*30.*)

8. Describe Clerget's process for the determination of cane sugar. (*30.*)

9. If, in refining 40 tons of raw beetroot sugar, of the following compositions:—

Sugar	96·20
Water	1·80
Ash	·78
Unestimated matter	1·22

a first crop amounting to 65 per cent. of white crystals of 100 per cent. purity is obtained, state the amount and composition of the syrup which would remain, assuming that it contains 20 per cent. of water. (*40.*)

The examination in "Sugar Manufacture" next year will be conducted by Mr. B. E. R. Newlands, F.C.S., F.I.C., and applications for examination must be made through the local Secretary of any affiliated College not later than March 19th, 1900. Programme and syllabus of subjects may be obtained through any bookseller, price 10d. net, and postage, 4d.

AUSTRIA.

As is well known, the total sum payable as bounty on sugar exports in any one season in Austria is limited to a fixed amount, which was raised a few years ago to fl. 9,000,000. Should the bounties exceed this maximum, the difference has to be repaid by the manufacturers. The *Prager Zuckermarkt* calculates the sum thus repayable for the season 1st August, 1898, to end of July, 1899, at fl. 5,078,326. This is equal to 37·372 kr. on each florin of the total bounty. There are 100 kreutzer to the florin. The figures of the bounties paid, as given approximately by the above authority, work out as follows:—

				Florins.
5,168,156	quintals of	Consum sugar @ fl. 2·30	..	11,886,758
1,376,988	,,	Raw sugar @ fl. 1·60	..	2,203,180
		Deduct sum repayable	..	9,000,000
				Fl. 5,089,938

This differs by fl. 11,613 from the total given above, but we are unable, with the data before us, to account for the discrepancy, which is not material.

The following changes have been introduced into the sugar legislation:—

Sugars polarising 90 to 99·3 will receive an export bounty of 3 kronen 20 heller per 100 kilos net. Those polarising above 99·3 receive 4 kronen 60 heller per 100 kilos net. The former 1st grade of sugars is abolished. The contingent or maximum of the total bounties remains unchanged, but the respective proportions of reimbursement of the excess are different for the three divisions, Austria, Hungary, and Bosnia with the Herzegovina.

The consumption tax is raised from 26 to 38 kronen for 100 kilos.

THE HAWAIIAN ISLANDS.

From a very good and concise report on these islands by Dr. Maxwell, Director and Chief Chemist of the Hawaiian Sugar Planters' Association, which was prepared at the request of Government, and appears in the July issue of the *Planters' Monthly*, we take the following interesting details on the sugar industry and the labour problem which so closely affects it. Some anxiety is being felt respecting the result of the new undertakings which have lately been set afloat, many of them, it is feared, highly speculative. It is asserted that no less a sum than about $25,000,000 will be required to meet the full calls, and, unless the money is found from outside there is great possibility of a panic. Labour is said to be scarce at the present moment, and wages are constantly advancing. Fortunately for planters, prices remain at a remunerative point.

SUGAR.—The production of sugar employs the major portion of the capital and labour upon the Hawaiian Islands; it also furnishes the bulk of the exports, and provides the wealth and maintenance of the great majority of the people.

It is about sixty years since sugar was first produced for sale upon the islands. At that time the methods of cultivation and manufacture were very crude and the production was small. Even so late as the year 1880 the total output is recorded as having been 30,000 tons. Without taking the time and care to traverse each stage in detail in order to show the "ups and downs" of the industry and by what efforts it has reached the present dimensions, it will be sufficient to state the total value of Hawaiian exports for 1897 and the proportion of that value accruing from the shipment of sugar: The total of Hawaiian exports for the year named amounted to $16,021,775·19, while the sales of sugar amounted to $15,390,422·13. These figures present at a glance both the sum of the trade which the islands transacted in 1897 with foreign countries (over 99 per cent. of which was with the United States) and the dominant and vital part that sugar plays in the industrial existence of the country.

Sugar is grown on Hawaii, Maui, Kauai and Oahu, the four largest islands in the group, and its cultivation is about to commence on the islands of Molokai and Lanai. There are some sixty plantations now in operation, each one having its own mill or factory equipped for the manufacture of raw sugar. The sugar-growing and sugar-making

capacities of these estates vary between less than 1,000 tons and near 20,000 tons of sugar per annum.

Much of the low, level, sedimentary areas bordering on the sea-shore are used for growing sugar, while the areas of rich, dark-red soils, located at comparatively low altitudes, are used exclusively for this purpose. Very considerable breadths of the less fertile yellow and light-red soils, with larger stretches of uplands that reach up to 1,500 feet, and in locations as high as 2,000 feet, above the sea, are also used, so far as it is found profitable, for sugar growing.

The relative fertility and values of the several soils are shown in the following statement from an official investigation, which embraces the average results of three successive crops:—

	Pounds of Sugar. Per acre.
Dark-red soils	10,411
Sedimentary soils..	10,301
Yellow soils	6,291

On an average two years are required to make a crop of sugar in Hawaii, while only one year is required in Louisiana, so that the sum of the Hawaiian yield requires to be cut in two in order to compare it more accurately with the annual production of Louisiana.

The area of arable land used in growing sugar in Hawaii may be deduced from the figures in the following table, which also shows the annual production of sugar:—

Year.	Cane Manufactured. Acres.	Sugar made. Tons (2,000 pounds).	Yield of sugar per acre. Pounds.
1895	47,399½	153,419½	6,472
1896	55,729	227,093	8,148
1897	53,825½	251,126	9,331

The average number of acres of cane manufactured for the three years given was 52,318. As the crop requires most of two years to mature, and as two crops are always in course of growth at the same time, it is seen that the acreage under cane is not less than 105,000 acres. Since some small areas of extreme uplands are two and a half years in reaching maturity, the above area must be considerably added to. Considering the further fact that some portion of the total area is always lying out for rest, we are justified in concluding that the land in use for cane growing is 125,000 acres.

* * * * * * * *

Formerly, and but little more than a quarter of a century ago, cattle were more numerous upon the islands. They had wider ranges to rove over and feed upon; they were the possessors of the land, and

their value consisted chiefly in the labour and hides which they yielded. At that time the plantations, which were of smaller areas than now, were almost wholly worked by bullock labour. Even to-day there are still thousands of oxen used in ploughing and hauling, their energies being utilised as mechanical force instead of in the form of meat. In the course of time, and that very recent, the sugar industry has undergone great expansion. The lands, some of which formerly were among the best for meat-making uses, have been absorbed by the plantations, and the cattle have been gradually forced within narrower limits at higher altitudes. With the increase in sugar the number of cattle has become relatively and constantly less. A first result of this change was that an adequate supply of "cattle labour" was not available. Room was thus made for mule and horse labour; more recently steam, as applied to the plough, has come in, and in some districts has almost wholly superseded animal labour in the field. With the extension of the use of steam for ploughing and hauling and the introduction of electricity where steam is less practicable, it appears a question of only a short time when the bullocks will be forever released from their yokes and the island cattle will be grown and used only for meat purposes. The present trend is wholly in the direction of a higher condition of things and the rate of change is distinctly rapid. Any change or reversion of the present relations of the sugar and cattle industries must depend chiefly upon the relative values of sugar and meat. At the present prices of sugar even the thinnest upland soils pay to plant with sugar cane. As an immediate fall in sugar value is not imminent, it is not apparent that any immediate change in the relations of the two industries will take place. However, this is not positive. When sugar declines from the present prices, which the cost of production makes probable in the near future (within the comparative short time of three to five years, as regarded by most authorities) and the price of meat goes up, then the land areas respectively under sugar and meat production will undergo some change. A fall of from 1 to 1½ cents per pound in the price of sugar and an increase of the same amount in the price of meat will put back certain areas of the uplands to meat production. This change would very materially aid the increased production of meat, and would not seriously, if at all, curtail the output of sugar, since those poorer uplands are the least productive in sugar, although among the best quality for grazing at certain seasons of the year. Moreover, experience has shown that a greater and more permanent

increase in sugar production is practicable by leaving out the worst of the uplands from sugar and concentrating labour, fertilisation, and costly water upon the richer and more durable lowlands. With a reversion of a part of the uplands to grazing purposes the sugar production can still continue to expand to the limits that have been stated.

* * * * * * * *

LABOUR CONDITIONS.—The hired labour of the islands is used chiefly upon the sugar plantations, other industrial labour requirements being small in comparison.

In line with the expansion of sugar production, the demands for labour have increased. Originally the labour was done almost wholly by Hawaiians, but as the requirements increased, coupled with the somewhat native objection of many Hawaiians to hire at regular labour, the leaders of the sugar industry were obliged to look elsewhere, and this led to the introduction of Asiatic and other labour. In the following table is presented a view of the component nationalities of the population, and the relative number of each nationality engaged in plantation labour.

1897.	Hawaiians.	Chinese.	Japanese.	Portuguese.	Other foreigners.	Total.
Population ..	39,504	21,616	24,407	15,191	8,302	109,020
Labour	1,497	8,144	12,068	2,218	756	24,658

These figures amply illustrate the labour relations of the respective nationalities to the main agriculture industry of the islands. The Hawaiians, relative to their number, do not seek plantation work, and when they do, it is chiefly as teamsters, in which work they are good and desirable. The inclination of the Hawaiian is to personal occupation rather than to labour for others. This is, in part, due to an objection to continuous labour, but more to the native instinct, which is averse to subjection, unless to Hawaiians of high standing or white people of authority. The writer hopes to see this characteristic of the Hawaiians maintained, and that the pride of the native people will assume such a course as to accommodate them to the new conditions in such a way that the race will yet re-establish for itself a permanent economic position in the community.

A reference to the figures of the above table also shows that the Portuguese do not generally go to plantation labour. These people are very energetic and thrifty. They are inventive along the line of introducing new small horticultural growths, such as the grape, etc. When they do work on plantations it is usually as teamsters, and they are comparatively highly paid for unskilled labour.

The burden of agricultural labour is borne by the Asiatics. One-third of the Chinese, and one-half of the Japanese populations are engaged in plantation labour The large remainder of the Chinese is privately occupied in rice or fruit and vegetable culture, or in domestic service.

Concerning the condition of the Asiatic labourers, it may be said, in general, that the presence of these peoples here demonstrates that the wages and personal comforts are greater in their present situation than they were in their native countries. This is further accentuated, in the case of the Japanese especially, by their disposition to settle permanently on the islands.

In regard to the question of compensation, a bare statement of wages does not cover the situation nor furnish a full comparison of the conditions that obtain here with the compensation of labour in other countries. The cost to the labourer of providing himself with fuel, clothing, and food is less on these islands than, for example, in Louisiana, or in any other section of the United States. On the other hand, the value of labour to the employer, where the labour is paid at so much per man per day, depends upon the labourer and his power to work. From this standpoint it is found that different nationalities are capable of rendering different amounts of labour per day, and they are thus paid different wages. The power to work and the rate of wages of the Asiatics are less than in the case of white men (and of coloured peoples in cooler climates) where the conditions of climate allow the latter to work. Where the climatic conditions exclude the white man the labour power of other races is also low.

General statements, however, upon this and all similar subjects are not of much value, so that a summary is here given of the labour roll for the month of December, 1898, from the largest sugar-making estate on these islands, the Ewa Plantation Company. All skilled labour, composed of Americans, British, Germans, and Norwegians, is excluded, only Portuguese and Asiatics being included:—

Labourers.	Number of Labourers.	Wage per Month. Dols.	Monthly Total. Dols.
Portuguese	34	27·55	930·70
Contract Chinamen....	204	15·16	3,092·64
Day Chinamen	67	16·73	1,120·91
Contract Japanese ...	380	15·66	5,950·66
Day Japanese	100	18·04	1,804·00
Total....	785		12,899·05

The differences between "day" and "contract" men are chiefly due to the fact that the day men are ex-contract and experienced labourers. It is thus seen that 785 labourers receive $12,899·05 in money, which is $16·43 per man per month, or 63 cents. per day. Where overtime is made by the labourers, either contract or day men, the time is duly paid for. If all the plantations were canvassed, the mean monthly wage would be found to be slightly higher than in the example given, since on the larger plantations the number of higher-priced men is relatively smaller than on smaller plantations. This is still more specially the rule in respect to skilled labour.

The table gives only the payment in money per month. All the labourers, however, receive free lodging, free fuel, and free medical attendance, and their children free education.

More point will be given to the statement of wages paid to labour on these islands if a comparison is made with the values of labour in corresponding conditions in the United States. For this purpose Louisiana is selected. In 1896, data upon the prices of plantation labour in Louisiana were furnished to the writer by the Hon. John Dymond, planter, editor, and sugar statistician of New Orleans. Mr. Dymond states in reply to questions: "The average monthly wage for years has been and is $20, or 75 per cents per day. This does not cover the grinding season (of some sixty days), when about $1 per day is paid." The grinding season in Hawaii lasts one hundred and fifty days or more, when special wages are earned by overtime. For the purpose of comparison the special wages are excluded in both cases, although that item is in favour of the Hawaiian labourer. Mr. Dymond further says: "The plantation labourers are furnished free house room; they steal their fuel, and require but little medical attention; work stopped by weather stops also the wages." These conditions are partly similar, but less favourable than corresponding conditions on Hawaiian plantations, the difference being decidedly in favour of the Hawaiian labourer. Again, the Hawaiian labourer requires less clothing, and, what is more important, he does not need to lose one day in the year from the weather. These considerations cause the comparison to be drawn as follows:

Place.	Wage per day. Dollars.	Wage per month. Dollars.
Louisiana	0·75	20·00
Hawaii	0 70	18·20

A detailed comparison, including the extra money earned by

overtime, would make the wages paid in the two localities almos , if not exactly, equal.

So far, the case has been stated for the labourer, showing the value of his labour to him. The cost of labour to the employer in Hawaii may now be shown. In addition to the 63 cents per day paid in money, the employer furnishes fuel, which is very dear (coal $10 per ton, wood relatively dear), and a free doctor, in addition to what is allowed in Louisiana. These extras raise the cost to 66 cents per day per man, but these extras are trifling in comparison with the extra cost per labourer per day that arises from the difference in the ability of the several nationalities to work. In the example given, the Portugese receive, on an average, $27·55 per month, and the Asiatics $15·93 per month, which indicates that the latter possess less power to work, and consequently are paid 43 per cent. less than the Portuguese. Mr. Dymond states that where men in Louisiana are on piecework the variation in their earnings is 37½ per cent. These examples are very pronounced, and probably extreme. It appears quite safe, however, to put the labour power of the Asiatic at 18 per cent. less than that of the mixed labour of Louisiana, which is equivalent to saying that four Louisiana labourers are equal to five Asiatics. The difference is greater rather than less than is stated. Then, in view of these special considerations, at least 18 per cent. has to be added to the 66 cents per day that the Hawaiian employer has to pay for his labourers, and this raises the cost of labour per day to 81 cents, which is 6 cents per day more than the average rate of wages in Louisiana as stated by Mr. Dymond.

There is extreme confusion existing in the matter of labour values in different countries, which is due to the fact that the daily wage is taken as the sole evidence of cost. This applies to other kinds as well as to agricultural labour. A house carpenter receives from 25 cents to 75 cents per day more than a corresponding carpenter in Honolulu, but the Boston man, owing to total suspension of business for about four months in the winter, earns very considerably less annually than the man in Honolulu, who practically has not to lay off a day in the year; and between what is called coolie labour, operating in warmer climates, and mixed American labour, or selected Asiatic labour, working in cooler climates, there are differences in labour power which cause extreme variations in the values and cost per day of those kinds of labour.

LOUISIANA.

The Sugar Crop.

To the lower half of Louisiana there is no crop so important as that of sugar cane. Upon the sugar industry the great mass of the population of this part of the State depend; hence the condition of that crop, while important to the whole State, is of the most vital consequence to the southern half.

Owing to the bad start which the cane crop made this year because of the deterioration of the seed from the uncommonly severe winter, more than the usual anxiety has existed as to the final outcome. Fortunately, while great damage was done during the winter, the loss was by no means so overwhelming as had been at first feared.

The growing season has been on the whole favourable, and although there were times when a lack of sufficient moisture was complained of, it does not appear that any material harm was suffered from that cause. The recent hot weather, although extremely uncomfortable to humanity, has been very favourable to the cane. On this subject, the Louisiana Planter, an accepted authority on the subject, says: "Some very hot weather has been experienced during the past week, and its effect on the cane has, of course, been beneficial. It has been growing weather in the fullest sense of the term. A universally hopeful feeling exists all over the sugar district, and while nobody is counting on a big crop, everyone is inclined to think that the final results will be a great deal better than they could have reasonably expected some months ago. A little cane with plenty of sugar in it will not be as bad as a large amount of cane with no sugar in it at all, as was our experience last year. This is especially true from the standpoint of the expense account, and we are gratified to note the better feeling now manifested in the sugar parishes."

It is noticeable that while nobody looks for a large crop during the coming season, all admit that the industry is in a satisfactory condition, and a feeling of hope and cheerfulness prevails among planters. There appears to be a determination to save a large amount of seed cane this winter, which, while cutting down the yield for this season, will insure the planting of a very large acreage for the next season. This of itself would seem to indicate a confidence in the future of the industry which is extremely gratifying.—*New Orleans Picayune.*

AUSTRALIA.

Federation as affecting the Sugar Industry.

That this question of federation which is now being so earnestly discussed in the Australasian Colonies is an exceedingly important one to the Queensland sugar producers is well shown in a clear and very impartial article in the June number of *the Sugar Journal*. By this time the present number is in the hands of many of our subscribers, the result of the general vote will probably be known, and it cannot be denied that the position of the Queensland sugar growers and manufacturers must be very seriously affected by the coming into operation of the scheme as propounded in what is known as the Commonwealth Bill. In reviewing the main points of the article before us, we are once more struck by facts on which we have frequently enlarged before, viz., the singular position occupied by the great sugar industry in almost every part of the world, in that it is so peculiary exposed to vicissitudes from which many other industries are free, and how largely it is a creation of more or less artificial arrangements which depend on special legislation for their maintenance, or are liable to be completely upset by political and social movements in other and often neighbouring countries. The annual sugar production of Queensland (say 150,000 tons) is stated in this article to involve a yearly expenditure of more than one and a quarter sterling to place it on the wharves. The entire export trade of the colony is under £11,000,000, "and it is safe to say that sugar goes very near to being responsible for a fifth of that amount." The sum at stake, if, as may well be assumed, federation will be unfavourable to the tropical sugar producer, is therefore relatively a large one. The total consumption of sugar in the limits of the proposed federation is estimated at only 180,000 tons, hence nearly seven-eighths of it concerns Queensland. It is therefore no light matter to decide whether that country can safely place its special interests in the hands of a federated Parliament, "both houses of which are elected by the whole of the people of Australia," and which will be "*dominated by those to whom the sugar industry is an unknown quantity?*" We use the italics to emphasize this most important point, for we do not hesitate to assume that the continuation of the production of sugar at present prices is dependent on the employment of other than white labour, and those who have followed the progress of events in this direction during the last ten years know how little chance there is of the maintenance by the other

colonies of the present laws permitting the use of coloured labour. It is no question of sentiment, but one of facts and figures, that has to be faced by the population of Queensland, and unless the Australian people as a whole are prepared to support the sugar industry by high import duties, and eventually to enter on the most undesirable path of granting bounties on export, it appears to us that this large and important industry will suffer far greater loss by federation than can be made up in any other direction, or than some of the sugar producers themselves seem to expect.

EGYPT.

The Daira Sanieh.

The report of the operations on these estates, as presented to H.H. the Khédive, is now before us. The provisional accounts for 1897 showed an excess of receipts over expenditure of £E48,536, which the definite accounts have reduced to £E42,865. The provisional accounts for 1898 show a much smaller excess, viz., £E20,802, from which has to be deducted a round sum of £E15,000, for probable arrears of rent. The Council explain that the quantity of cane delivered to the works was some 3,500,000 cantars (about 150,000 long tons) less than had been expected, consequently the sugar produced fell below the average.

The report states that the manufacturing results for 1898 were not satisfactory, which is attributable to the frosts which occurred in January. The canes were very inferior in quality, and the yield in 1st sugar per 100 cantars of cane crushed, which in 1897 was 10·6, fell to 8·50 in 1898, which, in proportion to the quantity of canes worked up, represents a loss of 288,000 cantars (about 9,975 long tons) owing to frost, equivalent to £E103,557.

The areas under cane cultivation belonging to the Daira Sanieh and the yields for the past three years were:—

1896.		1897.		1898.	
Feddans.	Cantars.	Feddans.	Cantars.	Feddans.	Cantars.
3,477	1,352,501	1,731¾	698,405	693¾	289,816

(The *feddan* is 1·06 acre, the *cantar* 98¼ lbs. avoirdupois.)

The result of the working of the nine factories during the campaign of 1898 (middle of December to end of March) was as follows:—

Canes worked up. Metr. tons.	1st Sugar obtained. Metr. tons.	2nd Sugar obtained. Metr. tons.	3rd Sugar obtained. Metr. tons.	Total all Sugars. Metr. tons.	Molasses. Metr. tons.
651,526	55,367	2,998	888	59,253	14,904

Of the molasses, 6,246 tons were distilled, yielding 1,089,603 kilogs. of alcohol.

The average cost of manufacture per 100 cantars of sugar was as follows, in £E and milliêmes:—

1896.		1897.		1898.
£E35·903	..	£E33·174	..	£E40·509

Quantity and Value of Sugar and Molasses produced on the Daira Estates, 1894 to 1898.

	1st Sugar. Cantars.	£E.	2nd Sugar. Cantars.	£E.
1894	1,479,034	846,880	156,323	52,368
1895	1,488,663	650,323	146,625	37,873
1896	1,672,035	859,675	146,608	45,723
1897	1,590,427	687,371	117,200	32,336
1898	1,232,875	555,919	67,440	19,844

	3rd Sugar. Cantars.	£E.	Molasses. Cantars.	£E.
1894	47,790	14,114	391,335	6,047
1895	36,027	8,967	451,098	4,511
1896	33,988	9,696	417,631	6,264
1897	34,531	8,855	332,666	7,053
1898	22,164	6,725	328,006	8,679

Percentage of Sugar and Molasses obtained from Cane.

Produce.	1895. Per cent.	1896. Per cent.	1897. Per cent.	1898. Per cent.
Sugar, 1st quality	8·56	9·23	10·06	8·50
,, 2nd ,,	0·84	0·81	0·74	0·46
,, 3rd ,,	0·20	0·19	0·22	0·13
All Sugars	9·60	10·23	11·02	9·09
Molasses	2·59	2·30	2·10	2·29
Totals	12·65	12·53	13·12	11·38

Some difference will be noticed between the way in which the details are given above and that of former years. Any such is due to the fact of the reports received hitherto having been drawn up by the Controller and published in England, whereas the present is the report of the "Conseil de Direction," published at Cairo.

The question of the legality of the sugar bounty law passed in 1897 by the State Legislature of Michigan is to be settled by the Supreme Court of the United States.

AUSTRIA-HUNGARY.

A Sugar Export Union.

According to the *Prager Zuckermarkt*, an Export Syndicate has been formed by a number of Austrian and Hungarian sugar factories and refineries, under the direction of the "Oesterreichische Credit-Anstalt für Handel und Gewerbe" and the "Allgemeine Credit Bank," for carrying on a direct export trade to Japan, and for this purpose it is intended to establish a permanent agency in that country. The initiative in the formation of this Syndicate was taken by the Credit-Anstalt, which has of late displayed unusual activity. Hitherto the export of sugar to Japan has been but limited, and it is only about a year ago that it commenced to improve. The amount cannot be ascertained from the lists of exports, because the business was carried on *via* Hamburg. Now, however, the "Austrian-Lloyd" is about to establish a new line to Japan, with the view of promoting the efforts of their sugar manufacturers to do business direct with that market.

We are informed that 15 prominent refineries and raw sugar (*Sandzucker*) producing factories in that country have united to establish an agency at Yokohama, for pushing the sale of Austro-Hungarian sugar. There will be a committee of nine members, and the management of the entire undertaking will be in the hands of the Prague Branch of the Oesterreichische Credit-Anstalt.

The matter has been mentioned and the entire plan explained to Count Thun, the President of the Ministry, who expressed himself most favourably towards the new undertaking, promised all possible support by the Government, and added that the agency might turn its attention to the sale in Japan of other Austro-Hungarian products.

The total import of sugar into Japan during the past three years in pikols of 60 kilograms (133 lbs.) was:—

	1896.	1897.	1898.
Raw sugar.. ..	918,000 ..	1,242,000 ..	1,610,000
Refined sugar ..	1,340,000 ..	1,963,000 ..	2,734,000

These imports have increased rapidly, and will continue to do so.

Willett & Gray (July 27th,) call attention to the receipts of foreign sugars at New Orleans this year, 46,866 tons, against none last year.

VENEZUELA.

The Sugar Industry.

Up to quite lately the sugar industry in this country was very much behind-hand as regarded modes of production and process of manufacture, and the quality of the article left much to be desired. This was partly owing to ignorance, but partly to the indifference begotten by the absence of competition, the duty on the imported article being so heavy as to exclude all but the very best refined qualities, which could not be obtained from the home manufacturer, and the consumption of these was naturally limited by the very high price. During the past two or three years certain improvements have been introduced into the native factories by French engineers, notably Mr. E. Delafond, an Engineer and Chemist, a member of the "Association des Chimistes des Sucrerie et Distillerie de la France," who has paid special attention to sugar manufacture and distillery in Mexico and Venezuela. After managing one large distillery and superintending the erecting and directing the working of another large plant in the former country, he turned his attention to Venezuela, where he has put down an installation at Juan Diaz, and has just leased for a long term the Haciendas Santa Eulalia, San José, San Carlos de Rio Chico, from which we shall soon hear good reports.

It is not too much to say that Mr. Delafond has inaugurated improvements which will soon revolutionise the industry in Venezuela, and he has lately received a substantial acknowledgment of his work, having been decorated for "exceptional services rendered to the sugar industry."

The British Consul at Caracas says: Sugar is now sold at 4d. a lb., and I am told it has cost 3½d. to grow. West Indians, I imagine, would be glad to get this profit, but ideas are larger in Venezuela, and sugar growing is a protected industry.

According to the *Louisiana Planter*, Governor Warmoth is about to add to his sugar factory at Lawrence, a mill for working up the bagasse into paper. This has always been a favourite idea with American cane planters, and we believe the only thing that has stood in the way is the large quantity of silicious matter.

CONSULAR REPORTS.

Belgium.

Values of exports of sugar to Great Britain for two years :—

	1897. £		1898. £
Raw	498,680	....	659,960
Refined..	520,680	....	344,520

Morocco.

The British Consul for the district of Dar-al-Baida says that the sugar imports come from France and Belgium, the refined article produced in the United Kingdom having been driven out of the market several years ago. The quantities and values for different ports for the last three years were as follows :—

	1896. Cwt.	1896. £	1897. Cwt.	1897. £	1898. Cwt.	1898. £
Rabat	39,182	39,282	40,172	40,165	39,226	39,226
Dar-al-Baida	—	—	62,833	55,571	83,875	62,111
Mazagan ..	36,305	36,264	48,080	38,468	26,655	13,328
Saffi	—	—	49,268	44,341	23,600	33,350
Mogador ..	59,620	57,820	56,460	56,383	—	—

It is evident that the values given above are calculated in different ways, possibly the customs duty is omitted in some cases and included in others. The competition of Belgian sugars is stated to be increasing.

China.

Chinkiang.—This place is said to have become the centre for distribution of sugar for the valley of the lower Yang-tse. The sugar imported is entered at the custom-house as foreign or native, not according to its origin, but according as it comes *viâ* Hong-Kong, paying full import duty, or is carried coastwise from a Chinese port, paying half duty. The bulk is really of Chinese origin, shipped chiefly from Swatow to Hong-Kong, and the dealers have a special and double object in this arrangement, connected with the *likin* charges at the endless barriers *en route* through the various provinces of Kiang-su, An-hui, Shan-tung, and Ho-nan. Imports and values for the past two years are given as :—

	1897. Cwts.	1897. £	1898. Cwts.	1898. £
Foreign, brown ..	319,885	144,070	249,501	125,821
,, white	39,072	34,489	35,600	33,101
,, refined ..	120,655	86,052	124,635	103,360
Native, brown	118,471	65,491	166,603	84,000
,, white ..	144,680	114,143	158,071	141,843
,, candy	8,826	9,980	8,951	10,528

Canton.—Imports and values of sugar for the past two years:—

	1897. Cwts.		1897. £		1898. Cwts.		1898. £
White ..	55,756	..	30,950	....	23,233	..	13,163
Brown ..	3,009	..	1,170	....	150	..	66

Java.

The British Vice-Consul says that in spite of the fact that sereh attacks the Cheribon cane more than other sorts, none of the newer kinds have been found equally good under varying circumstances of weather and soil, though a further extension of them is certain to be effected next planting season. He gives the following figures as the yield (in tons) for the last five years:—

1894.	1895.	1896.	1897.	1898.
488,307	550,508	501,122	546,750	689,104

The 1899 crop will probably not be far short of that of 1898.

Philippine Islands.

Exports and approximate values of sugars exported from Manila, Cebu, and Iloilo for for the two past years:—

	1897. Tons.		1897. £		1898. Tons.		1898. £
Iloilo.. ..	130,542	..	788,368	....	154,402	..	1,110,494
Cebu	15,324	..	122,592	....	12,466	..	87,262
Manila ..	57,352	..	—	....	15,661	..	—

The destinations were:—

	1896. Tons.		1897. Tons.		1898. Tons.
United States and Canada	98,621	..	24,353	..	27,997
Great Britain	39,311	..	47,037	..	46,780
Spain	3,547	..	1,775	..	180
China and Japan	88,430	..	128,928	..	102,738
	229,909		202,093		177,695

San Domingo.

Sugar exports for the twelve months ending 31st March, 1899, are given as 49,300 tons. Sugar remains the principal industry.

Dutch West Indies.

Curaçoa.—The value of sugar imports for three years was:—

1895. Florins.		1896. Florins.		1897. Florins.
101,592	....	110,826	....	82,575

About 60 per cent. came from Venezuela, 20 per cent. from the United States, the remainder mostly from Holland.

Nicaragua.

The exports of sugar for 1898 were 180 tons, mainly to the neighbouring Central American Republics.

BRAZIL.

Pernambuco.—Exports and values of sugar for the past two years:—

	1897. Tons.	1897. £	1898. Tons.	1898. £	Destination.
White sugar ..	58,656	702,655	59,602	774,826	Brazilian ports.
,, ,, ...	62	871	69	897	Portugal.
,, ,, ..	—	—	134	1,742	Argentine Rep.
Muscovado	25,055	208,335	18,803	169,227	Brazilian ports.
,, ...	14,035	66,402	20,032	120,192	United States.
,, ...	10,257	44,125	11,284	67,704	Great Britain.
,, ...	207	1,532	78	468	Portugal.
Yellow Crystal sugar	1,621	16,748	—	—	United States.
,, ,, ..	38	1,487	—	—	Great Britain.
Refined sugar ..	609	9,192	629	9,435	Brazilian ports.

Ceará.—Exports of sugar for three past years :—

1896. Tons.	1897. Tons.	1898. Tons.
187	67	—

Maceio.—The exports of sugar for the past three years were :—

1895-96. Tons.	1896-97. Tons.	1897-98. Tons.
46,929	28,705	44,890

Of last year's crop 26,441 tons went to New York; 12,070 to Brazilian ports; and 6,379 to Liverpool. The export to the ports of Rio de Janeiro and Santos is increasing rapidly.

The British Consul at Pernambuco writes (May, 1899) :—

"In my report for the year 1896, I wrote with regard to sugar that while the production in Pernambuco is stationary, or, in fact, rather less than five years ago, the export to foreign markets has dwindled down to 65,000 tons. This falling-off in the production has each year since become more accentuated, and it will be of interest to give the following figures :—

	Quantity. Tons.
Total production in Pernambuco for 1896	159,460
,, ,, 1897	124,428
,, ,, 1898	131,820

while the export to foreign markets from Pernambuco only amounted to 31,500 tons in 1898.

"The primary cause for this decreased production is, of course, the baneful influence of bounty-fed sugars, the most important result of which is the ever-increasing beetroot sugar crops on the Continent of Europe, and, to a minor extent, the heavy import duties on sugar in the United States, not only in Louisiana where the sugar-cane is cultivated, but also of beetroot crops in the Western States.

"While statistics are continually printed in New York, Liverpool, and London, showing the export of sugar from Brazil, at varying estimates from 125,000 to 150,000 tons per annum, it may be useful to those interested to know that such figures have been entirely misleading for many years past, and that neither the United States nor Great Britain can count on any appreciable supplies from this country unless the production greatly increases, and that can only come about by some protection, whether by countervailing duties on bounty-fed sugars, or in any other form that may be devised by the cane-producing countries, which have been so severely crippled by the keen competition of protected beetroot. But here in Pernambuco the climatic influences have also been at work, and due importance must be given to them, for it is well to bear in mind that, owing to the large consumption of sugar in Brazil, a small crop means very remunerative prices to the planters, and hardly comes into competition at all with the supply of sugar for the world's consumption."

Bahia.—Exports of sugar for four years:—

1894. Tons.	1895. Tons.	1896. Tons.	1897. Tons.
14,866	8,855	5,600	3,371

This goes almost exclusively to the United States and Great Britain in constantly varying proportions, but in 1896 the whole went to North America.

Paraguay.

The "Empresa Azucarera del Paraguay" factory started in September, 1898, and turned out a very fair article, but not in sufficient quantity for the consumption. The results for 1899 are expected to be much better, as there is an abundant crop of cane.

Chile.

Imports of refined sugar for two years:—

1896. Metr. Tons.	1897. Metr. Tons.
7,422	8,267

Of the latter, 6,872 tons came from Germany, and 809 tons from France; Great Britain sent only 321 tons (685 tons in 1896), and the remainder came from Belgium and the United States.

Guayaquil.

There are eleven sugar estates in the country, and of their production about 4,000 tons were in 1898 consumed in the country. The export for that year amounted to about 2,500 tons, but a part of this was surplus from the preceding year. Some 900 tons went to Chili, a similar quantity to Liverpool, 450 tons to Panama, and 250 tons to

Liverpool. The British Consul says the sugar is of excellent quality, large white crystals, and in Colombia and Chili is preferred to that coming from Peru.

Portuguese East Africa.

The British Consul at Chinde says:—

"As regards the sugar industry on the Lower Zambesi, there are possibilities of this growing to very large proportions. The delta of the Zambesi consists of a very rich soil, and sugar cane thrives exceedingly well under proper conditions of cultivation, and it may be well to mention what they are.

"Firstly, the land must be well ploughed, as it is a hard soil and covered with long-rooted grass. The ploughing must be done during the dry season, and steam-power is an essential to success and economy.

"Secondly, as the country is very flat, the land opened up for sugar cultivation must be well drained.

"Thirdly, it is necessary to water the cane during the seven months dry weather (June to December) when no rain whatever falls.

"This is done by means of large Swyne pumps of 15 inches diameter, the water supply being from the Zambesi; the drains used for carrying off the heavy rains of the wet season are also used for the requisite irrigation on the plantation of the Syndicat Agricole du Luabo at Marromen on the bank of the Zambesi, where some 600 acres are under cultivation, and the canes now growing on this estate are most excellent specimens, and promise results of a very satisfactory nature. The company have a very large set of "Fowler" steam ploughs that are capable of ploughing from 12 to 15 acres per day.

"I have to thank Mr. A. Michel, the Manager of the Company, who opened up this plantation in June, 1897, for the above information.

"The Syndicat Agricole du Luabo has just been converted into a company with a capital of £150,000. A sugar factory will shortly be erected for crushing, in October, 1900, capable of turning out 40 tons of sugar daily; the machinery will be from the well-known firm, Fives-Lille, and the management of the company will be under the supervision of Mr. Charles Gabel.

"The greater part of the delta of the Zambesi is well fitted for the growing of rice and mealies and oil seeds, the latter being the principal export of the country; three crops of mealies can be

produced yearly, against one in South Africa. The delta is also highly successful for the raising of cattle.

"At Mopea, sugar has been grown for some years, and during the past 12 months about 1,000 tons have been exported through Chinde to Lisbon, whilst some 13,620 demijohns of rum (equal to about 60,000 gallons) manufactured at Mopea, have been shipped to Delagoa Bay, *en route* to the Transvaal."

CONDENSING PLANTS.

SEPARATE CONDENSING PLANTS FOR FACTORY PURPOSES.*

By Sir Alfred Seale Haslam.

The application of condensers of various kinds to steam engines dates from the time when the celebrated engineer, Watt, took out his patent for an injection condenser. The older system adopted was the application of a condenser to each separate large engine, leaving the medium and small-size engines without condensers; but in many modern installations, where a large number of various-sized engines are used in connection with the works, or more particularly in electric light stations, it has been found advisable to have one large condenser to receive the steam from the various engines which may be distributed over the works or installations. In cases where this arrangement is not carried out a large number of engines are frequently left unprovided with a condenser, the result being increased working expenses in coal consumption. A large condenser tends to economy and efficiency, also a reduction in first cost and economy in maintenance. Very careful tests have been made at factories where engines have worked without condenser, and by the application of a condenser common to a large number of engines an economy has been secured amounting to 20 per cent. or 30 per cent. in the coal consumption. On board ship these condensers are found to be of immense value.

The old practice was to convey steam to the condenser of main engines, but when the steamer is in port and the main engines are not at work, the auxiliary engines for electric light, refrigerating machinery, winches, cranes, and various engines used on board ship must either work high pressure or exhaust into the main condenser without a vacuum.

* Paper read before the Engineering Conference of the Institution of Civil Engineers (Section III.—Machinery), June 9th, 1899.

By having a separate condenser fitted with an air pump, and into which all the various engines can exhaust their steam, the condensed steam is available for feeding the boilers, the efficiency of the engines is maintained, and a reduction of coal consumption is the result.

Condensers may be divided into four classes or types :—

First, the injection condenser.

Second, the ejector condenser.

Third, the submerged or closed surface condenser.

Fourth, the evaporative or open-air condenser.

The first or injection condenser, in construction and working, is for all practical purposes the same as when patented by Watt, consisting of a condensing chamber with spray or injection pipe, air pump, and hot-well. The advantages of this type are: Simplicity in construction, fewness of working parts and non-liability to get out of order, easy cleaning, and cheapness in first cost. This condenser, however, has several disadvantages. Unless the condensing water available is of good quality the hot water cannot be used for feeding the boilers; thus the condensed steam is lost; neither is it possible to obtain so good a vacuum with an injection condenser as can be obtained from a properly constructed immersed surface condenser. The working of this class of condenser is as follows: Steam enters the condensing chamber, where it comes in contact with a spray of cold water, which raises the temperature during the time it absorbs the latent heat and condenses the steam into water. A considerable volume of air is brought over with the steam, some with the injection water, and some also due to leakages. To remove the air and water a pump is provided, necessarily of larger capacity than that used for a surface condenser, seeing that both the air and water require to be removed; this pump delivers the water into the hot-well, and the air is discharged by a pipe. The designs of pumps and condensers of this type are very numerous, some are vertical patterns fitted with single or double-acting air pumps; others are horizontal pattern, fitted with single or double-acting air pumps. Both bucket and displacement pumps are used according to the idea of the different engineers.

The second type, or ejector condensor, is a modification of the ejector for boiler-feeding purposes; no air pump is required. The mode of working is briefly as follows: Exhaust steam from the engine enters the ejector at a very high velocity, meeting about twenty times its weight of cold water passing through the jet at a lower speed, this velocity causing a momentum sufficient to convey the water, steam,

and air into a water-sealed discharge pipe or hot-well. Any rotation of the water is objectionable. The condensation of steam is dependent upon the length of the water and steam columns to produce an efficient vacuum. The objection to this style of condenser is that unless the water is good it cannot be used for boiler-feed purposes. Furthermore, they require very careful adjustment, and unless this be accurately done, the ejectors cannot be depended upon to keep a steady vacuum. These condensers are not considered very reliable, because a little dirt or obstruction will clog and impede the flow of water; when this happens the exact areas, which are regulated by cones, are interfered with, and this prevents the efficient working of the condenser. As a rule, the vacuum obtained is not high—approximately a vacuum of 14 in. to 18 in. may be relied upon.

The third type, or immersed surface condenser, is more expensive than the othor two classes mentioned, but is considered the most efficient; the great benefit by the introduction of this condenser, as applied to marine purposes, cannot be over-estimated. This condenser was invented by Samuel Hall, of Basford, Notts, about 1840, and was first applied to the steamer Hercules, running between Cork and Liverpool. An account of this condenser was given in the *Mechanics' Magazine* of July 18, 1840. It is very remarkable to note that Mr. Hall admits that when he introduced this condenser it met with most serious opposition on the part of the marine engineers of that day, showing how little they appreciated the importance of this invention, which was destined to prove of such great value to marine engines in the future. The general construction of this type of condenser is as follows:—

A number of solid-drawn copper or brass tubes are enclosed in a casing, generally made of cast iron, and are supported by end-plates at each end of condenser. In the early type of condensers the tubes were expanded with a drift, and later by an ordinary tube expander, but it was found that frequent leakage occurred, and when the tubes required to be examined, they were seriously damaged at the ends by being removed, and often unfit for use again. At a later period wood ferrules were introduced, but these were found not altogether satisfactory, owing to the leakages which arose from time to time.

At the present time the most approved manner of securing the tubes in the end-plates is to drill the end-plates and form a stuffing-box on the outside of each end-plate, which is screwed to receive a gun-metal nipple or gland, which may be packed with cotton or other suitable

material; the gland is then screwed hard on the packing, and this makes a perfect joint and prevents any leakages.

When it is required to remove the tubes the glands are slacked back, the tubes are then easily removed for examination, and can be replaced without difficulty and at a nominal cost. A difference of opinion exists as to whether the tubes ought to be made of solid-drawn copper or brass. The author's experience is that if the tubes are properly tinned, it is not of any great importance which material the tubes are made from. It is well known that distilled water has a strong action on both copper and brass.

The air pumps used in connection with this class of condenser are the ordinary vertical or displacement type, the ordinary being generally single-acting, the displacement double-acting.

The water-circulating pumps may be ordinary piston type, but centrifugal pumps are very largely adopted, the centrifugal pumps being driven by a separate engine.

The method of working these condensers is extremely simple. The exhaust steam is conveyed from the engine, admitted to the casing of condenser and plays upon the outside of the tubes, cold water being circulated through the tubes by a pump, as described, the condensed steam in the form of water being drawn away with the air and delivered into the hot-well. A feed pump is generally attached which conveys the condensed steam back to the boiler. In order to obtain the best results, however, great care should be taken with the design, so that the steam is properly distributed over the entire tube surface; if this detail be not carefully attended to the steam will often make a short cut or passage to the air pump without being properly condensed, and should this be the case very frequently the vacuum is 5 in. to 6 in. below what it ought to be, provided a perfect distribution of steam is not maintained over the tubes.

It is usual in designing condensers for marine purposes to give rather larger surface per indicated horse power, in order that the condensers may not fall off to any material extent in efficiency when the boats are passing through the tropics.

There are many advantages in using and working this type of condenser.

First, any kind of water can be used for condensing purposes. Secondly, the heat of condensation is utilised to advantage by feeding with water raised to a high temperature. Thirdly, fuel is saved because it is not necessary to blow off the boilers so frequently in

order to remove the sediment or accumulation of dirt. Fourthly, the size of boiler can be reduced owing to the fact that hot feed-water is used for boiler-feed supply. Fifthly, the life of the boiler is prolonged by reason of the fact that it is kept free from scale or accumulation of dirt.

On the other hand, there are some drawbacks and adverse conditions; an additional pump is required over and above what is needed for the injection condenser. The space occupied is greater than that required for the injection condenser. The tubes of the immersed surface condenser require attention and cleaning in order to maintain the best results and the highest efficiency. The first cost is greater than that for the injection condenser, and a larger amount of condensing water is required, as the interchange of heat is not so thorough as in the injection type, where the water and steam come in contact with each other.

The fourth type, or evaporative or open-air surface condenser, was first used by Messrs. Pontifex and Wood, Limited, engineers, of London (whose business is now carried on by the Haslam Foundry and Engineering Company, Limited, of Derby and London), about forty or fifty years ago, and patented by that firm, who made a number of these condensers for sugar refineries, not only abroad, but also at the East End of London. Such condensers have been used in connection with vacuum pans and steam engines. For a time this type of condenser was rather neglected, cheaper forms of condensers being used; but where a limited supply of water only is available these condensers are absolutely necessary. During the past few years the attention of engineers has been drawn to this particular type of condenser, and they are now being made in various forms by different engineering firms. The condenser first made by Messrs. Pontifex and Wood had large round copper pipes about 4 in. in diameter, secured at each end into a copper diaphragm, the said diaphragms being made in sections, each of about ten 4 in. pipes; the diaphragms were about $\frac{1}{8}$ inch thick, and being of this thickness, effectually provided for expansion. They were secured to D-shaped cast-iron boxes made the same length, the ends of which were flanged for bolting together endways.

Messrs. Pontifex and Wood, before the expiration of their patent, found by experience that smaller pipes were more effective, and the size was reduced from 4 inch in diameter to 2 inch in diameter, and instead of placing cast-iron boxes or standards at each end, they

placed the box at one end, connecting the pipes together at the opposite end by a horse-shoe bend, thus providing for expansion, and giving the steam a longer travel or passage through the tubes. When possible, the condensers were placed on the top of the building in an exposed situation, in order that they might obtain the full advantage of a current of air, as it was found that the vacuum obtained on a windy day was much better than on a day when very little breeze was available. These facts have been fully recognised of late by many engineers, and have led to the extended use of fans, which materially reduce the water consumption and improve the efficiency of the condensers.

The amount of water used by these condensers varies according to the circulation of the air, and is only about one thirtieth the quantity of that required or used in an immersed surface condenser. Various forms have been adopted for the evaporative condenser, some being made of cast-iron, others of wrought-iron, copper, and brass. One type of condenser consists of cast-iron pipes arranged vertically, the upper part of the pipes being jointed together by horse-shoe bends, and the bottom ends jointed or secured to a cast-iron box common to all the pipes. The condensing water is distributed, causing it to flow into small basins or cups, one on each pipe near the upper end having an annular space between the pipe near the edge of the basement.

Other condensers have wrought-iron pipes arranged horizontally, but unless these are galvanised, or otherwise protected, decay rapidly takes place; in fact, even with proper galvanising the life of these condensers is very limited. Experiments have been tried by placing inside the tube a device for splitting up or distributing the steam. Other engineers use corrugated tubes, with the surface partially flattened, to effect the same purpose.

With regard to the use of copper tubes in this type of condenser, it should not be forgotten that one square foot of surface in copper is worth more than double the amount of surface in iron.

With regard to the various forms, or external shapes of the tubes, any deviation from the round form causes trouble, because they are difficult to keep clean. The plain round form is the easiest to keep clean. It is very difficult to get condensing water free from lime or other substances which may deposit on the surface of the tubes, and if this be allowed to accumulate, the efficiency of the apparatus soon becomes impaired.

The main points to be studied in the consideration of an evaporative

surface condenser are—simplicity of form, a sufficiency of surface, carefully designed joints carefully made with special tools. Even when the greatest care is exercised on account of the number of joints, the vacuum obtained is not generally so good as that obtained by the immersed type of surface condenser.

Discussion.

Mr. H. Shield, Liverpool, said he should like to state as a matter of history that the first surface condenser was applied in 1835 to the Windermere, and that the Hercules was fitted in 1836. It had 1760 tubes, ½ in. in diameter, and 4 ft. long. It was identical with the condensers now made, except in the matter of packing. His firm made large numbers of evaporative condensers, particularly for abroad, where water was often scarce and bad. There had not been so much demand for them here, but now that factories had often to buy their water from public supply companies, there was good reason why such condensers should be used in this country. At his works they had a deep well, but they had had to sink it lower and lower, as their neighbours drew more largely on the underground supplies; and now the water had turned brackish, and they had put up an evaporative condenser for themselves, and avoided paying for water. Experience told them that for each pound of steam passed through the engine, rather less than a pound of water would be evaporated on the condenser pipes. The use of a condenser reduced the quantity of water used per horse-power in the boiler, and therefore the coal bill. Of course a condenser occupied space, but it could often be placed on the roof. It was very advantageous also to have a cooling tower, and then to keep a large quantity of condensing water in circulation. That prevented the water getting so dirty, and insured a better vacuum. To condense 15,000 lb. of steam per hour they allowed 1600 square feet of surface in the condenser, and provided a cooling tower 36 ft. by 28 ft. This gave a 26 in. vacuum. In another case, dealing with 156,000 lb. of steam, the condenser had 13,000 square feet of surface, or 1 square foot for 12 lb. of steam per hour.

Mr. W. P. Abell, Derby, who had had considerable experience with condensers in factories using multiple evaporators, pointed out that they enabled their users to observe, measure, and test the condensing liquid and water before and after, the vapour to be condensed, and the condensed vapour, with a regularity and extent not well possible in the ordinary condensing plant of a steamer or land engine; this experience

emphasized, he said, the following points, which, though recognised in land and marine engine condensers, were not usually acted up to.

1. The increased vacuum on a windy day instanced by Sir Alfred Haslam, pointed to the value of circulation; and Mr. Shield would bear him out in the statement, that attention to circulation has in many marked cases increased the efficiency 25 per cent. Four years since, he made some trials and experiments showing an efficiency of 50 per cent. with fair, as compared with sluggish, circulation.

2. Shrouding, or allowing the cooling surface to be lagged with air. He had seen the insertion of a few air-cocks convert an inefficient into an efficient condenser. The German engineers recognised this very fully.

3. Dirty cooling surfaces would quickly reduce the efficiency of a condenser. He had seen this cause alone reduce the useful work by 75 per cent.

Recognising the success of the stage practice of dealing with heat from the time that Watt introduced his separate condenser to our own day with compound engines, and the fact, as pointed out by Mr. Shield, that 1 lb. of water only was theoretically necessary to condense 1 lb. of steam, that our best plants took 7 lb. of condensing water, and that for land purposes, this excess of water was often a drawback to the adoption of condensers, it appears that an efficient evaporative condenser would meet with success. Certainly the 12 lb. vacuum did not give the larger differences of pressure and temperature that are available when dealing with the higher pressures of steam, but still one must remember the fact that in the stage or multiple evaporator, designed by Rillieux some 60 years since—and which is the base of all the hundreds of recent successful multiple evaporators with their condensers—the available difference of temperature is 212 deg. to 150 deg. Fahr. = 62 deg. Fahr., and this divided into apparatus commonly having three stages, but at times having as many as ten stages, giving a difference available for the condensers at each stage in the former case, if equally divided, of 20·6 deg. Fahr., and 6·2 deg. Fahr. in the latter. In passing he might mention that a most interesting feature in these apparatus is that this temperature is not anything like equally divided.

Mr. Basil Wilson had hoped that the discussion would turn on the subject of providing a separate condensing plant to take the exhaust of all the engines in a works. Also, he would have liked to hear something on the relative merits of surface and jet condensers. The

object was to get instantaneous elimination of steam to the hot-well. The thing was to bring down the temperature and pressure of the steam instantly, but not necessarily to the lowest point possible, because that involved cooling the cylinder unduly by radiation. It was not desirable to go below 130 deg. Fahr. Either jet or surface condensers would dispose of the steam effectually. The former brought in a large quantity of entrained air, and the latter accumulated the oil in the feed water. The jet condenser fulfilled all requirements on land.—(*Engineering.*)

MONTHLY LIST OF PATENTS.

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ENGLISH.

APPLICATIONS.

12459. J. Mc.Neil and C. Mc.Neil, Glasgow. *Improvements in evaporating or concentrating apparatus.* 15th June, 1899.

12598. R. Temme, London. *An improvement in the manufacture or refining of sugar.* 16th June, 1899.

12703. The Westburn Sugar Refineries, Limited, and R. F. Lyle, London. *Improvements in treating icing sugar.* 19th June, 1899.

12726. G. Dawson, Barnsley. *New or improved sugar dissolving apparatus.* 19th June, 1899.

13349. E. Williams, Manchester. *Improvements in steam motors of the turbine or rotary type.* 27th June, 1899.

14356. D. Stewart, Glasgow. *Improvements in high pressure clarifying apparatus for saccharine solutions.* 12th July, 1890.

14659. W. M. Huskisson, London. *Improvements in and relating to rotary turbine engines.* 17th July, 1899.

14890. M. Guttner, London. *Centrifugal apparatus with continuous action.* 19th July, 1899.

15292. M. de Marchéville, London. *Improvements in centrifugal machines.* 25th July, 1899.

15451 E. Kafka, Manchester. *A process for purifying molasses for use in the manufacture of pressed yeast.* 27th July, 1899.

15508 and 15509. W. Reeves and The Reeves Patent Filters Company, Limited, London. *Improvements in filters for filtering liquids.* 28th July, 1899.

16093. C. Vogelsang, London. *Improvements connected with filter presses.* 8th August, 1899.

16304. R. Landmann and N. Reif, London. *Improved process and apparatus for centrifuging, drying, impregnating, and moulding plastic materials.* 10th August, 1899.

ABRIDGMENTS.

8222. M. B. Zahn, Artern, Thuringia, Germany. *Improvements in or relating to the treatment of sugar molasses or syrup by means of lime.* (Complete specification.) April 19th, 1899. This invention relates to the precipitation of sugar from a molasses or syrup solution by distributing or applying oxide of calcium in a finely powdered form to the solution while in motion, whereby every particle of lime dust falls separately into the solution and at once combines with the sugar so that the formation of calcium hydrate is avoided, whereas in the case of introducing lime conglomerate only the surface particles enter into reaction with the sugar, while the central portions are slacked or converted into calcium hydrate, not only being useless in the reaction but also producing a degree of heat whereby the sucrate of lime already formed is decomposed. The new process thus possesses a great advantage as compared with the old processes inasmuch as the quantity of lime used is greatly reduced. This means not only a great saving in lime, but also an increased yield of the plant. Then the great heat produced by an overdose of lime is avoided, thus effecting an economy in the use of cooling water. Finally, this process offers the great advantage that the lime sugar produced is in a granular condition, which can be filtered and washed very easily, thus producing for further manufacturing processes a purer juice and filling material. The treatment according to this new process on a large scale may be carried out, to illustrate an example, in such a manner that an ordinary sifting apparatus or a sieve fitted with some sifting material of fine texture, or any other powder distributing contrivance, for the purpose of separating the lime dust from the coarser particles of the material, is placed directly above the vessel containing the molasses or syrup solution, provided with a stirring device. The fine particles falling from the sifting or distributing apparatus or sieve, fall on the surface of the solution like a cloud of dust and are taken up in the most perfect manner by the liquid owing to the operation of the stirring device.

18143. W. P. Thompson, British and Foreign Patent Solicitor, Liverpool, London, and Birmingham (communicated by J. C. Boot,

of Klatten, Java). *Improvements in the purification of syrup, molasses, and the like.* 23rd August, 1898. This invention relates to improvements in the decolorization of syrups, molasses, and vegetable juices, and consists essentially in treating these syrups, molasses, or vegetable juices with zinc and sulphurous acid, forming hydro-sulphurous acid, and afterwards precipitating the zinc with a soluble ferrocyanide. In carrying out the invention the syrups, molasses, or vegetable juices, of a concentration below 50° Brix, are heated to about 50° C., and with constant stirring, zinc and sulphurous acid are added; the liquor is then heated to a temperature say 80° C., and a soluble ferrocyanide is added till all the zinc is precipitated. The liquor is then filtered or decanted in order to free it from the precipitate of ferrocyanide of zinc. In order to carry the said process into operation, the following is the process: the syrups, molasses, or vegetable juices are brought to a concentration of about 40° or 50° Brix, in a reservoir provided with stirring apparatus and steam heater. The temperature must not exceed 50° C. Constant stirring being maintained, zinc is added in quantities varying from 5 to 25 grammes per hectolitre and sulphurous acid till strong acid reaction is obtained. After the decolorization is finished, the reservoir is heated to a temperature ranging from 70°-95° C. and a soluble ferrocyanide is added in order to precipitate the zinc; the ferrocyanide of zinc is separated from the saccharine solution in a suitable filter. The decolorized syrups, molasses, or vegetable juices are worked up into sugar in the usual well-known way. By way of further explanation it may be added that it is preferred to employ ferrocyanide of potassium in this process, and that the precipitated ferrocyanide of zinc may be separated by filter presses, bag filters, suction bags, centrifugal machines, or any apparatus designed to separate solids from liquids.

16540. J. Robin-Langlois, Paris, Engineer and Chemist. *Apparatus for the rapid refining of sugar.* 29th July, 1898. This invention relates to a new process for refining sugar and to apparatus for carrying the same into effect. The object is as follows:—To artificially make a mass of ground, blued and damp sugar allowing an easy moulding, and giving, after treatment, sugar having all the properties of refined sugar without however, creating objectionable products during the different stages of the operation. The process is the following:—Sugar known as raw sugar No. 3, or rather, extra white sugar which has first been cleaned by any known process, and

particularly so as to remove the hair, dust, etc., which may adhere thereto, arising from contact with the sacks or bags, is then ground by means of a crusher or disintegrating apparatus. This latter may be of any suitable pattern or type, and should be able to produce small crystals of uniform size, and also be able to vary the size of the products as needed. The sugar having been ground passes over a spray of atomized water or jet of steam at a suitable pressure and by this treatment the crystal fragments undergo a kind of washing, the facets or faces thereof become brilliant and acquire a condition similar to that of the grains which are formed in a cooked mass, and further, these particles are slightly damped; the sugar is afterwards conveyed to a mixer furnished internally and externally with means for heating; this mixing is indispensable because whatever be the division of the sugar and of the water under the form of atomized steam or spray, certain particles of ground sugar at the entrance into the mixture, will have received a deal of dampness, others on the contrary will present themselves under the form of amorphous agglomerations; it would be found impossible to form an ingot or bar under these conditions, even under great pressure, the mass having no homogeneity. On the other hand, if it be wished to prolong the action of the water, (steam or spray), an excess of liquid would be used which would form a soft pulp or paste, which latter it is necessary to avoid so as not to have inferior products or to obtain low class results. To attain a good result the sugar after having been damped should be submitted simultaneously to a thorough mixing and to the action of heat. It is then mixed in a mixer furnished internally and externally with means for heating.

19961. W. P. THOMPSON, Liverpool. *Refining Raw Sugar.* (A communication by H. A. J. Manoury, Paris.) 20th September, 1898. This improved method of refining raw sugar consists in producing only refined sugar and final molasses, and dispensing with by-products or bastard sugar, said result being obtained by the operations which may be summed up as follows:—1. In working with white sugar, boiling the green refinery syrup until grain or crystals of the desired size are obtained, then continuing the boiling with the whole of the rich drainings from a previous boiling, and completing with a given quantity of poor drainings from the same previous boiling, so as to lower to a minimum the purity of the mother liquor of crystallisation of the masse-cuite in preparation. 2. In working with brown sugar, boiling the green syrup until grain of the desired size is obtained,

then adding thereto refining syrup and then rich drainings from the preceding boiling, and finally a given quantity of poor drainings in order to lower to a minimum the purity of the mother liquor of the masse-cuite in preparation. 3. In order to reduce the poor drainings remaining in excess of the degree of molasses, that is to say, reduce their degree of purity (for instance, from ·68 to ·60) taking a portion of said drainings and treating same with baryta and strontia in order to form corresponding saccharates and mixing the mother liquor for preparing these saccharates with the poor drainings remaining, so as to lower its purity to that of molasses, the operation being conducted in the same manner hereinbefore set forth. 4. The use of saccharate of baryta or of strontia for purifying casting syrups by separating the sugar from the saccharate by means of sulphurous or other suitable acids, or by means of sulphate of magnesia or other like salts in the manner hereinbefore set forth.

GERMAN.

ABRIDGMENTS.

101737. RUDOLPH BERGREEN, Roitzsch, near Bitterfeld. *A double knife shredder.* (Addition to Patent No. 67276. 13th July, 1890.) 4th December, 1897. In order to avoid by the knife arrangement patented under No. 67276, the escape of small uncut pieces of beet root and to still further accomplish the division of the beetroot and the like, a hinder knife is provided furnished with cutters.

102163. R. STUTZER and W. WERNEKINCK, Güstrow. *Preliminary separating process applicable for raw syrup.* 17th August, 1897. The raw beetroot juice is treated with sulphurous acid at from 45 to 75 degrees, until the albumen, which is precipitated in large flakes, is completely separated out. Organic acids are thus liberated from their salts simultaneously, thus augmenting the acidity of the juice, inversion of the saccharose does not, however, take place. The juice is then neutralised with baryta or lime, the organic acids being thereby separated as lime or baryta salts, the precipitate, which is difficult to filter by itself, being then, with the addition of siliceous earth, filtered off at from 80 to 85 degrees.

102648. LEOPOLD MAY, Hungary. *Process and machine for producing sugar bars and the like.* 13th August, 1897. This invention relates to a process and a machine for producing sugar bars, so that the masse-cuite is poured into a hollow receptacle formed by an outer and inner shape. After the masse-cuite has stiffened, first the outer shape and then the inner one are removed on a frame similar to a

draw-bench. The sugar bars which are released from the shapes, are removed by a conveyor, which protects them from being broken.

102827. H. Stoepel, Brehna, near Halle, a/S. *Knife-boxes for shredding machines.* 8th January, 1897. This invention has for its object a knife-box for shredding machines, whose longitudinal sides, which are parallel to the knife, are inclined in the direction of the rotation of the cutting surface against the upper surface of the same. The perpendicular end sides are supported by narrow projections attached to the underside of the disc.

103057. Otto Rötzsch, Leipzig. *Improvements in shredding presses.* 4th August, 1898. The presser-flyers of the press spindles are provided with a cut-out piece in which the shaft of a cleanser, shaped like a scraper or brush is guided. The cut-out piece has an enlargement at the outer end of the presser-flyer. This enlargement serves for the reception of a spring. The spring is for the purpose of pressing the cleanser continuously against the inner casing surface of the press cylinder, so that on the rotation of the press-spindle by means of the cleanser, the opening of the press cylinder for permitting of the passage of material is kept clean.

UNITED STATES.

ABRIDGMENTS.

626597. Frank L. Depew, of Brookline, Mass. *Centrifugal machine.* June 6th, 1899. This invention relates to a centrifugal used the manufacture of various products—such as sugar, salt, soda, &c.—in fact, any solid material having a large percentage of moisture, or mixed with liquor where it is desired to separate the solid and fluid, and that in a rapid and economical manner, by the employment of centrifugal force. The invention providing for the above object is a machine that is simple and compact in form and construction, and effective in operation, and the liability to get out of order is reduced to a minimum.

Patentees of Inventions connected with the production, manufacture, and refining of sugar will find *The International Sugar Journal* the best medium for their advertisements.

The International Sugar Journal has a wide circulation among planters and manufacturers in all sugar-producing countries, as well as among refiners, merchants, commission agents, and brokers, interested in the trade, at home and abroad.

REDUCTION OF METRIC MEASURES TO IMPERIAL MEASURES.

Measures Converted.	Process Adopted.	Error in the Result: Correction Additive or Subtractive.
Centimetres to inches	Divide by 10 and multiply by 4..	0·6 in. in a metre, or 1·6 per cent. subtractive.
Metres to yards..	Add one-tenth..	1·9 ft. in 100 metres, or 0·6 per cent. subtractive.
Kilometres to miles	Halve and add one-tenth of the original quantity ..	2 miles in 100 kiloms., or 3·5 per cent. additive.
" "	Add a 0 and divide by 16	0·4 mile in 100 kiloms., or 0·6 per cent. subtractive.
" to knots	Add one-tenth and take one-half	1 knot in 100 kiloms. subtractive.
Hectares to acres	Take one-quarter then add a 0	3 acres in 100 hectares, or 1·2 per cent. subtractive.
Cubic metres to cubic yards	Add one-third	1·8 per cent. subtractive.
Litres to gallons	Add one-tenth, double, and divide by 10	2 gallons in 100,000 litres subtractive.
Grammes to grains	Add one-half and multiply by 10	0·4 grain in 1 gram., or nearly 2·8 per cent. additive.
Kilograms to pounds	Add one-tenth and double..	¼ lb. in 100 kilos., or 0·2 per cent. additive.
Metric tons to English tons	Subtract 1 ton in 60..	Less than 1 ton in 1,000, or 0·08 per cent. additive.
" " " "	Subtract 16 tons in 1,000	0·2 ton in 1,000, or 0·02 per cent. additive.

Reduction of Imperial Measures to Metric Measures.

Measures Converted.	Process Adopted.	Error in the Result: Correction Additive or Subtractive.
Inches to centimetres..	Add a 0 and take the quarter	4 centims. in 100 in., or $1\frac{1}{3}$ per cent. additive.
Yards to metres	Subtract one-eleventh	0·5 metre in 100 yards, or 0·6 per cent. additive.
Chains to metres..	Double and add a 0	11·7 metres in 100 chains, or 0·6 per cent. additive.
Furlongs to metres..	Double and add a 0 twice	117 metres in 100 furlongs, or 0·6 per cent. additive.
Miles to kilometres	Add one-half and one-tenth..	0·9 kilom. in 100 miles, or 0·6 per cent. additive.
Nautical miles or knots to kilometres	Subtract one-tenth and double..	½ kilom. in 10 knots, or under 3 per cent. additive.
Acres to hectares..	Double twice and divide by 10	½ hectare in 100 acres, or 1 per cent. additive.
Cubic yards to cubic metres	Subtract one-quarter	$1\frac{1}{2}$ cubic metres in 100 cubic yards, or 2 per cent. additive.
Pints to litres	Add one-tenth and halve	2 litres in 100 pints, or 3·3 per cent. additive.
Quarts to litres..	Add one-tenth..	$3\frac{1}{2}$ litres in 100 quarts, or 3 per cent. additive.
Gallons to litres	Multiply by 10, subtract the original number, and halve..	5 litres in 100 gallons, or 1 per cent. additive.
Grains to grammes..	Subtract one-third and divide by 10	2 grammes in 100 grains, or under 3 per cent. subtractive.
Pounds to kilograms	Subtract one-tenth and then halve	⅓ kilo. in 100 lbs., or 0·8 per cent. additive.
British tons to metric tons.. ...	Add $1\frac{1}{2}$ per cent.	1 ton in 1,000 additive.
" " " "	Add 15 per 1,000..	5 tons in 100,00 additive.

IMPORTS AND EXPORTS OF SUGAR (UNITED KINGDOM).

To end of July, 1898 and 1899.

IMPORTS.

Raw Sugars.	Quantities.		Values.	
	1898.	1899.	1898.	1899.
	Cwts.	Cwts.	£	£
Germany	3,377,388	2,715,046	1,508,561	1,358,764
Holland	168,488	272,251	69,057	126,554
Belgium	566,625	885,356	247,924	435,786
France	1,365,255	929,950	682,312	525,208
Java	60,708	104,332	33,110	61,152
Philippine Islands	542,190	161,149	233,504	73,872
Cuba and Porto Rico	14,380	1,320	8,108	1,000
Peru	706,405	254,301	352,317	142,845
Brazil	385,304	55,185	180,747	28,662
Mauritius	11,560	97,000	5,614	47,138
British East Indies	229,130	368,323	96,590	190,298
British W. Indies, British Guiana, & Brit. Honduras	683,113	691,621	412,077	513,032
Other Countries	421,210	685,223	203,015	386,467
Total Raw Sugars	8,531,756	7,221,057	4,032,936	3,890,778
Refined Sugars.				
Germany	6,550,411	6,963,888	3,967,464	4,335,740
Holland	1,291,939	1,259,173	828,363	832,077
Belgium	233,641	185,465	148,082	119,617
France	1,267,541	1,294,826	782,498	820,459
United States	6,967	5,607	7,544	6,310
Other Countries	35,377	28,906	20,897	18,773
Total Refined Sugars	9,385,876	9,737,865	5,754,848	6,132,976
Molasses	602,736	822,247	155,659	206,083
Total Imports	18,520,368	17,781,169	9,943,443	10,229,837

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden and Norway	58,174	42,125	34,140	26,573
Denmark	77,466	82,623	39,450	46,855
Holland	62,881	60,327	35,172	36,955
Belgium	9,810	7,939	5,502	4,886
Portugal, Azores, &c.	46,214	43,788	25,448	25,047
Italy	23,995	12,076	12,678	7,003
Other Countries	121,689	120,234	70,120	73,036
	400,229	369,112	222,510	220,355
Foreign & Colonial Sugars.				
Refined and Candy	108,459	93,383	66,519	60,573
Unrefined	289,902	171,940	158,437	103,444
Molasses	168,277	56,308	51,425	18,292
Total Exports	966,867	690,743	498,891	402,664

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1899. Tons.		1898. Tons.
Total Receipts, 1st Jan. to 17th August	1,133,616	..	887,499
Receipts of Refined ,, ,, ,, ..	1,645	..	18,064
Deliveries ,, ,, ,, ..	1,133,882	..	900,242
Consumption (4 Ports, Exports deducted) since 1st January	1,036,507	..	859,116
Importers' Stocks (4 Ports) Aug. 16th..	5,205	..	56,973
Total Stocks, August 23rd	185,000	..	251,528
Stocks in Cuban Ports, August 23rd ..	43,000	..	68,803
	1898.		1897.
Total Consumption for twelve months ..	2,047,344	..	2,071,413

CUBA.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, 1898 AND 1899.

(Tons of 2,240lbs.)	1898. Tons.		1899. Tons.
Exports	180,164	..	248,915
Stocks	85,745	..	49,639
	265,909		298,554
Local Consumption (seven months)	28,650	..	22,800
	294,559		321,354
Stocks on the 1st January (old crop)	1,515	..	4,336
Receipts at Ports up to 31st July	293,044	..	317,018

JOAQUIN GUMA.

UNITED KINGDOM.

STATEMENT OF SEVEN MONTHS' IMPORTS, EXPORTS, AND CONSUMPTION FOR THREE YEARS.

	1899. Tons.		1898. Tons.		1897. Tons.
Stock, 1st January	76,930	..	90,030	..	139,623
Imports, Raw Sugar, Jan. 1st to July 31st	361,053	..	426,588	..	362,257
,, Refined, Jan. 1st to July 31st ..	486,893	..	469,294	..	445,602
,, Molasses, Jan. 1st to July 31st ..	41,112	..	30,137	..	33,061
	965,988		1,016,049		980,543
Stock, in 4 chief Ports, July 31st	57,000	..	89,000	..	74,000
	908,988		927,049		906,543
Exports (Foreign, and British Refined) ..	34,538	..	48,343	..	56,479
Apparent Consumption for Seven months.	874,450		878,706		850,064

Stocks of Sugar in Europe at uneven dates, August 1st to 19th, compared with previous Years.

In thousands of tons, to the nearest thousand.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	Total 1899.
52	265	292	134	49	792

	1898.	1897.	1896.	1895.
Totals	987 ..	922 ..	1082 ..	1118

Twelve Months' Consumption of Sugar in Europe for Three Years, ending July 31st, in thousands of tons.

Great Britain.	Germany	France.	Austria.	Holland, Belgium, &c.	Total 1898-99.	Total 1897-98.	Total 1896-97.
1644	789	562	380	452	3827	3738	3439

Estimated Crop of Beetroot Sugar on the Continent of Europe for the current Campaign, compared with the actual crop of the three previous Campaigns.

(From Licht's Monthly Circular.)

	1898-99. Tons.	1897-98. Tons.	1896-97. Tons.	1895-96. Tons.
Germany	1,725,000 ..	1,852,857 ..	1,836,536 ..	1,615,111
Austria	1,055,000 ..	831,667 ..	934,007 ..	791,405
France	835,000 ..	821,235 ..	752,081 ..	667,853
Russia	795,000 ..	738,715 ..	714,936 ..	712,096
Belgium........	220,000 ..	265,397 ..	288,009 ..	235,795
Holland........	155,000 ..	125,658 ..	174,206 ..	106,829
Other Countries..	160,000 ..	196,245 ..	202,990 ..	156,340
	4,945,000	4,831,774	4,902,765	4,285,429

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

The month opened with a further slight advance in prices for prompt beet, which at one time was quoted at 11s., and even 11s. 0¾d. This was due largely to the firmness of holders, but about the end of the second week a relapse set in, which continued as time went on until quotations declined to 10s. 1d., recovering again to 10s. 4¼d., and again falling to 10s. 3d. New crop beet remains tolerably steady, and this may be accounted for by the low level of stocks and the feeling that the prospective production may very likely prove to fall below the requirements of next season, though, of course, no certainty whatever can be arrived at in this direction. The American refiners are said to have purchased all the raw Java cargoes afloat, and this will very likely put them in a position to abstain from buying any old crop beet, but they will almost certainly have to draw on the European markets somewhat later on.

The British refiners have been able to keep up their prices, the inference being that stocks are extremely reduced. The business in cane sugars is still very much restricted, owing to the poor supplies, but prices have given way slightly during the month.

At the moment of writing there is a further slight fall in the price of prompt beet, but little indication of any definite movement, nor is there any feature of sufficient importance to warrant any expression of opinion as to the immediate future.

The following quotations are in all cases for prompt delivery :—

			Last Month.
Porto Rico, fair to good Refining	11/0 to 11/6	against	11/0 to 12/0
Cuba Centrifugals, 97°/₀ polarization....	12/0 to 12/6	,,	12/3 to 12/6
Java, No. 14 to 15 D.S.	12/6 to 12/9	,,	12/3 to 12/6
British West India, fair brown	10/9 to 11/0	,,	11/3
Bahia, low to middling brown	10/0	,,	10/3
,, Nos. 8 and 9..	10/6 to 10/9	,,	11/0 to 11/3
Pernams, regular to superior Americanos.	10/3 to 10/9	,,	11/3 to 11/6
Madras Cane Jaggery	10/0	,,	10/0
Manila Taals	9/6 to 9/9	,,	9/3 to 9/9
French Crystals, No. 3, f.o.b.	11/9	,,	12/1½
Russian Crystals, c.i.f..	?	,,	?
German granulated, f.o.b.	12/1½	,,	12/4½
Tate's Cubes..	16/0	,,	15/10½
Beet, German and Austrian, 88%, f.o.b. ..	10/1	,,	10/9

THE

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☞ All communications to be addressed to EDWARD SUTTON, Office of *The Sugar Cane*, Manchester.

Advertisements from those desiring employment are inserted FREE OF CHARGE. All Advertisements to be sent *direct*.

☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

Messrs. Blyth Brothers and Co., Mauritius, report shipments of sugar from 1st to 28th August as 1,828 tons, principally to India. The following is the final report for the twelve months 1st August, 1898, to 31st July, 1899 :—

	1897-98. Tons.	1898-99. Tons.
United Kingdom and Europe	3,410	8,119
America	12,291	44,576
Australasia	10,836	6,494
Cape	31,532	27,856
India	62,180	96,797
Hong-Kong	695	1,446
Other Countries	750	1,199
	121,694	186,487

The noteworthy points are the considerable increase in the shipments to the United States and India, and the decrease in those to the Cape and to Australasia. The latter market will probably soon cease to take Mauritius sugars.

It is to be presumed that Mr. Chamberlain is just now too fully, if not anxiously occupied wtth the affairs of the Transvaal to find time to consider the reports on Central Factories in the West India Islands which it is known have been in the hands of the Colonial Office for some weeks. At any rate nothing has as yet transpired respecting them.

It is very satisfactory to learn that the Queensland Government is taking active interest in the establishment at Mackay of a proper Sugar Experiment Station. In addition to the necessary experiment fields for growth of canes and trials of manures, there will be an efficient lavatory and students (of whom the *Sugar Journal* says three have already entered) will not only be trained in all kinds of analysis, but in the keeping and arranging of necessary data for the chemical control of sugar mills. We may feel sure that an enormous benefit will be conferred on the Queensland industry and the sugar industry in general by this institution, the existence by which has now become indispensable wherever it is desired to keep sugar planters and manufacturers up-to-date and able to compete with their opponents whether in the home or the world's market.

A short time ago we mentioned that the Moreton Central Mill had been taken over by the Queensland Government, owing to being unable to carry on without further aid. The Government Auditor's report showed that, as regarded the manufacturing operations, the mill made a clear profit of 11s. per ton last season. It is evident, therefore, that the manager and his subordinates know how to make sugar and to make it so as to pay. The facts indicate that there has been a want of wisdom in other directions, as will be seen from the following extract from the *Queenslander* :—

"Several questions of importance arise. The first is whether the property will cover what has been expended on it under Government loan? It may be taken as certain that it will not, apart from the vigorous carrying on of the concern. The second question, therefore, is whether the Government is a fit or likely party to carry the concern to success? We do not think so, and we cannot but regard it as a serious misfortune that the State should take over this mill, and we cannot but ask with some apprehension whether other mills are likely to follow this example. And we hope the cause of failure will be gone into thoroughly. Whether the mill has been badly located, whether its tramway system has been wisely laid out, whether its management has been suitably provided for, whether due publicity has from time to time been given to its state of affairs—all these points have been or may be suggested as calling for inquiry. And the collapse will, we hope, lead up to increased exertion on the part of central millowners throughout the country, and increased vigilance on the part of Government as to full compliance with loan conditions."

The correspondent of the *Queensland* has been down to the New South Wales sugar districts, and the following extracts from his report will be read with interest :—

"On the Clarence river the Colonial Sugar Refining Company has issued a manifesto to cane contractors, stating that the following varieties of cane have been approved, and may be planted during the ensuing season :—Striped Tanna, Green Tanna, Moore's Purple, Rappoe, Mauritius Ribbon, Induria, Black Java, and Light Purple. Other canes

amongst which may be named the China, Purple St. Louis, Bamboo Rayee, Louzier, Batse, Purple, Black Isaacs, Black Cane, Striped Isaacs, and Oiva may be planted in certain portions of the district; but before making arrangements, farmers should obtain the consent of the Company's cane inspector. The Company draws particular attention to the necessity there is of exercising every possible care when selecting cuttings to see that they are free from the gum disease. It is also recommended that as far as possible cuttings be taken from ratoons that have hitherto shown no signs of disease."

* * * * * * * * * * *

"A vote was taken by the Company of all cane contractors as to whether the latter would prefer to be paid per average density or by individual analysis. Of 302 votes recorded, 252 were in favour of the former. The price the Company will, therefore pay is 10s. per ton in the field, and if the cane is worth it, a bonus will be paid at the close of the season."

The question of the production in India of jams, &c., from their native fruits is being taken up, as will be seen from an extract from an Indian journal given in the present number.

Geheimrath Professor Dr. Paasche, a member of the German Reichsrath, started on the 31st August, for the United States and the West Indies, for the purpose of studying the sugar industry and trade in those countries, and is expected back in Berlin at the end of the year. It is understood that his mission is an official one, the information being required by Government.

We have lately received the following publications, some of which we hope to notice at some length in our next issue:—

The Influence of Temperature on the Specific Rotation of Sucrose, and Method of correcting Readings of Compensating Telescopes therefor. By Harvey W. Wiley, a valuable paper read before the American Chemical Society and Section C. of the American Association for the advancement of Science, and before the Third International Congress of Applied Chemistry at Vienna.

Lavas and Soils of the Hawaiian Islands: a very complete monograph on the origin and nature of these soils and their availability, together with the elements of plant food which are removed from them by water and through cropping.

Die Zucker-Industrie um 1830. By Dr. Edmund Otto von Lippmann, Director of the Hallé Sugar Refinery.

Zuckerrohr, Kultur, Fabrikation und Statistik. By Walter Tiemann, Directeur de la Station Agronomique à Cheik Fadl (Haute Egypte).

The firm of J. Goddard & Co., Ltd., Bath, announce in the columns of *Confectionery* that they intend in future to use only cane sugar in the manufacture of their various lines of confectionery. They have tried both, and have ultimately resolved "to renounce beet and stick to the good old Colonial-grown, English-refined cane sugar."

The papers on "Glucose," by Mr. Sigmund Stein, which appeared in our April, May, and June numbers, have been reprinted in separate pamphlet form, and may be had from the Office of this Journal, price 6d., post paid.

WEST INDIES.

(Continued from page 455.)

The next subject taken in hand by the Conference was that of Central Factories and the results to be expected from their erection in the West Indies. This is a question to which *The Sugar Cane* has from time to time referred for some years past, as affording in our opinion the only solution of the query as to whether and how it was possible to keep up the competition with other sugar-producing countries, and maintain the staple industry of the West Indies in a paying condition. The subject was therefore very accurately described by the President as "one not only of great importance, but of immediate interest." Even were the beet sugar bounties effectually combated by countervailing duties, which we consider to be the primary and absolutely necessary measure for putting the sugar industry on a sound financial basis, it is certain that but verv few, if any, of the West Indian Islands could maintain the struggle with Europe, Java, Egypt, Peru, and the Philippines, without a total reconstruction of the means and modes of cultivation and manufacture, such as is only possible by the combination of interests, reduction of expenses and general improvement of everything connected with the industry, which is offered by the setting up of central factories and the construction of the necessary means of transport and intercommunication.

It had been intended to have two papers on this subject, one by Mr. W. Douglas, the Agricultural and Technical Chemist at Plantation Diamond, British Guiana, the other by Mr. Francis Watts, at that

time Government and Agricultural Chemist for Jamaica, who had had considerable previous experience in the Leeward Islands, and has since returned to Antigua as Chemist in charge of the Sugar Cane Experiment Department in those islands. For some reason not given the paper by Mr. Douglas was not read, but it is printed in the *West India Bulletin* now before us.

The keynote of Mr. Douglas's paper is the absolute necessity for reducing the cost of production, and he commenced the consideration of the possibility of this being effected by giving tables showing the average results obtained in various countries with the processes at present in use. These may be shortly stated as follows:—

		Extraction. Per cent.
Barbados ..	Average single crushing and muscovado process	70·40
Other West Indian islands, British Guiana and other corresponding countries.	Dry double crushing with the best mills, steam clarification, filter presses, multiple effect evaporation, boiling in vacuo. 1st and 2nd refining sugars made	85·00
	Double crushing with maceration, same methods of manufacture as the above, but low sugars returned into process. 96° crystals made	88·50
	Triple crushing with maceration, manufacture as above, *selected* low products returned into process. Methodical boiling and improved treatment of the masse-cuite: 96° crystals made..	90·00
In Hawaii .. (crop 1895)	Same process as the last, but with superior triple mills. 1st, 2nd, and 3rd refining sugars made	92·46

Mr. Douglas remarks that the extraction in this latter case is very high, but that even better results were obtained by C. Saillard, in Cuba (in 1894), and by Manoury in the Argentine Republic (in 1897). We may add that we were informed nearly three years ago, that quite as good results were being got in Queensland with processes not quite so complete as those referred to as in use on the Hawaiian plantation in question. Mr. Douglas gives the extraction in a good beet sugar factory as below:

	Extraction
Germany. Diffusion, Carbonation, &c., process ..	96·67

and adds that practically as high a recovery of sucrose as this has been recently obtained in *one sugar*, by returning selected low products into the working, and by improved treatment of the masse-cuite.

Special stress is laid by Mr. Douglas on the importance of compensating the largest item in the cost of sugar production, that of the initial cost of the raw material, by means of high extraction, and he also pointed out that, from the very nature of the case, only large factories can be in a position to effect the necessary reduction in the general expenses of manufacture. This is the great unanswerable argument for the establishment of central factories. Granted that smaller factories might dispose of the capital required for thorough re-equipment with the best and most modern appliances, the economy effected by concentration under the most skilful direction enables the large factory to do what the smaller cannot. This is the experience which has had to be made under the modern conditions of constantly keener competition in all branches of production the world over. He met the one great objection to central factories, that of the separation between agriculture and manufacture, by showing that the benefits outweigh the disadvantages. The real position which estate owners and sugar producers have to face is, to our mind, and on their own showing in the evidence before the Royal Commission and in all the subsequent proceedings that have been published, simply this, that with things as they are they cannot long continue to exist, while with proper central factories and the total re-organisation and re-construction of ways and means which their establishment will necessitate, there is, from a financial point of view, still a satisfactory prospect before them.

The paper before us proceeds to lay down on tolerably broad lines the principal conditions essential for the successful establishment of central factories, many of which are naturally those which would infallibly suggest themselves to the mind of anyone capable of dealing with the subject. The most interesting point seems to be the intimate connection between the cane growers and the factory authorities, the former being *directly* pecuniarily interested in the success of the factory, and Mr. Douglas clearly recognises this practical co-operation as the only solution of the difficulty connected with the price to be paid for the canes. He is speaking of the colonies in general, and goes so far as to lay down the principle that where the canes contain an average of 13·5 per cent of sugar, 10/6 per ton might be paid for the cane taken at the estate, with a further

payment out of the profits of the year's operations, naturally, if there are any. It will be seen later on, and it was also clearly shown in the report of the Committee of Planters appointed to consider Sir Cuthbert Quilter's suggestions, that this is much below the estimated cost of growing canes in Barbados, and it is to be feared that few planters will be found willing to accept so low an initial payment, further remuneration being entirely conditional on the working of the factory over which they could have but little actual control. Mr. Douglas in no way overlooks the variety and peculiarity of the factors that have to be dealt with in the matter in hand, indeed he admits that the installation of central factories has special difficulties connected with it, and enumerates them as follows:—

"The raw material is bulky; extensive and costly permanent "transport arrangements require to be laid down and maintained, and "the supply of canes from various points must be accurately adjusted "from day to day. With large output, the products must be of a "nature and quality to command prompt and ready sale at current "prices without disturbance of markets. The requirements are, "however, well understood, and given a well-designed modern "installation, and a plentiful supply of cheaply-grown canes, good "management is the final important factor necessary to secure "success."

But, as we have already previously remarked, anyone who wants to study these questions and form an opinion of any real value, must read the papers in their entirety, and he will then be in a position to understand the unmistakable benefit which such meetings as the one held at Barbados last January can confer in elucidating the various difficult points connected with such intricate and, for those most nearly concerned, all important subjects. The most unfortunate feature in these matters is that the steps which are now being contemplated ought to have been fully discussed years ago, for it is imperative that any action now taken should, to be of real avail, be prompt and untrammelled by minor considerations, for which there is now literally no time.

We must now pass on to consider briefly the paper by Mr. Watts, which has the special feature of being written largely with a view to the conditions of the "smaller West Indian Islands."

Mr. Watts divided the West India Islands and British Guiana into groups, one in which the conditions are specially favourable to growing canes rich in sugar, and one in which special difficulties, climatic and

other, are encountered, resulting in the production of poor canes; the first including Barbados, the Leeward and the Windward Islands, the second chiefly British Guiana and Trinidad, with Jamaica as intermediate.

In the second group, natural disadvantages had, as is frequently the case, been compensated by improved machinery and methods. In the first group natural advantages and a plentiful supply of labour had caused them to remain behind-hand in appliances, and consequently the old wasteful muscovado processes were still prevalent, and the introduction of improved machinery and methods had not been effected. The result was that "we have in Barbados (as the typical "example) and to an almost similar extent in some of the Leeward "Islands, a highly developed agriculture, with well tilled cane fields, "as free from weeds as if they were gardens, while the manufacture "of sugar remains imperfect, wasteful, and the wonder of those "familiar with the methods followed in most other countries." He gave an average of analyses of the juices of a season's work on ten estates, showing 1·91 lbs. of sucrose and ·0744 of glucose, and for another season, 1·806 lbs. of sucrose, and ·09 of glucose, per gallon of juice, the percentages of total solids by weight being in the latter case 19·330, and of sucrose 16·859, glucose 0·832, non-sugar 1·639.

One of the great reasons why the muscovado process could not make head against the severer conditions of competition in late years was the fall in the demand for and the price of molasses, the remunerative production of this low-class sugar being in fact largely dependent on a ready sale for its rich molasses, which has been suffering from the competition of refiners' and glucose syrup.

Mr. Watts then gave some accounts of investigations made by him in Antigua, which had led him to believe that the average percentage of juice expressed by the whole of the mills in the Island *did not exceed 55 per cent.*, the losses varying from 27 to 36 per cent., in comparison with what might be obtained with good mills. It was therefore to be expected that such planters as had, with these and other disadvantages, been able to hold their own, had much to gain, and might hope, by the adoption of proper measures, for the return of their former prosperity. Those measures consist in "the abandonment of the muscovado industry, and the adoption of modern methods, including high crushing, multiple-effect evaporation, and vacuum-pan crystallisation." Mr. Watts did not think the best results would be obtained by the erection of one or two large factories, but by the

substitution of several moderate-sized factories, with the estates grouped round them, for the existing imperfect mills and ordinary boiling-houses. Like Mr. Douglas, he insisted on the interests of the factory owners and of the land owners being identical, the success to be shared by both parties. He went at some length into the financial question, and indicated the initial price for cane as from 10s. to 11s. per ton.

This very important point was taken up in the next paper by Mr. J. R. Bovell, Superintendent of the Botanic Station in Barbados, whose long experience in that colony entitles his opinions to a respectful hearing. By the aid of elaborate statistics he arrives at the opinion that "under existing circumstances canes are not grown *on the average* (in Barbados) for less than 13s. per ton," this high average, as compared with what is believed to be the average cost in British Guiana, Trinidad, &c., being due to the intensive cultivation and large use of manures. Mr. Bovell bases the calculations in his tables on the assumption of 13½ tons of cane being required for one ton of sugar. He arrives at the following conclusions as regards Barbados:—

1. The average cost of cane production is about 13s. per ton.

2. The value under present system of manufacture and at rates for sugar current last season is about 12s. 9½d. per ton.

3. With a similar average price for sugar, but with a properly-equipped co-operative central factory system of manufacture, cane is worth 15s. per ton.

There was some expression of opinion after the reading of these papers. Professor Harrison thoroughly endorsed the view as to the necessity for central factories, while thinking Mr. Watts had rather underestimated the yield of juice obtained by the mills, at any rate in Barbados. Mr. Watts objected to the high rate of cost arrived at by Mr. Bovell as not being consistent with the official statements laid before the Royal Commission by the Planters' Committee. The President remarked that though Mr. Bovell's figures seemed very high, there was apparently no one present in a position to correct them, and he suggested exactly what has been in our mind all the time we have been perusing these two papers, viz., that, possibly, a higher price could be paid for canes in Barbados"—and it might be added, Antigua also—"because of their greater richness in sugar." The extraction of juice per ton of canes must certainly be capable of being largely increased by the adoption of the best mills, with cutters or crushers, and maceration.

(To be continued.)

ON RECENT ATTEMPTS TO DO AWAY WITH THE AFTER-PRODUCTS.

By Rudolf Hafner. *

Although the different methods at present in use for working up of the after-products have been considered in our separate branches, the committee of the Central Association was induced to give notice of these various methods for to-day, because the present assembly consists of representatives of the entire monarchy, and there is a good opportunity for ventilating our views and exchanging opinions on this question which, of late, has attracted so much attention.

The endeavour of the sugar chemist has at all times been to increase the yield of the first product, whether raw or white sugar, and correspondingly to decrease the amount of the green syrups, the so-called after-products. Other great questions, however, has for some years been coming to the front, such as diffusion, clarification of the juice and evaporation, and it was only when these questions had been solved, as far as circumstances permitted, that attention was again turned to the working up of the after-products, and while formerly, as already mentioned, only the increase of the yield of first product was kept in view, without any regard to the time required for working up the runnings, of late years efforts have been made to shorten it much as possible. And so the two points which have been recently aimed at have been: production of the highest possible yield of first product and the best and quickest extraction of the sugar in the green syrups.

The methods which serve or are intended to serve this purpose are very various, and may be grouped for the sake of better consideration in the following way; it may, however, be mentioned that the classification of these methods is made only according to the manner of their practical application, without taking into account their chemical reactions or other special properties.

I. Increase in the yield of first product by elaborate purification of the juice. (Use of sulphurous acid; Ranson's process; Ozone process; various electrolytic processes of clarification; Harms process, &c.)

II. Working up the green syrups by their reintroduction into the manufacture. (*a.*) In the manipulation of the juice (Böcker,

*Read at the General Meeting of the Central-Verein für Rübenzuckerindustrie in der öst.-ung, Monarchie, 1899.

Zscheye, Löblich, Mügge-Pfeiffer, etc., processes). (b.) During boiling (methods of Wulff, Stenzel, etc.).

III. Independent working up of the green syrups.

(a.) By free formation of grain.
- (α) crystallisation at rest (the old so-called tank working).
- (β) crystallisation in movement (Wulff-Bock, Berggreen and Claasseu processes).

(b.) By introducing already formed crystals.
- (α) with crystallisation in movement (Wulff).
- (β) sub-induction process (Wulff).

(c.) By artificial formation of grain (Abraham, Freitag, Fuchs, Grasse, Maranc, Sachs, and other processes).

IV. Methods of extracting the sugar from the molasses (clarification, elution, substitution, Mallikh and Henke, Barytes, and lead saccharate processes).

I shall attempt to discuss shortly some of the processes which are most frequently ventilated at our meetings.

I. Increasing the yield of the first product and correspondingly decreasing the after products by elaborate purification of the juice.

(1.) By employing sulphurous acid.

The simplest and cheapest method of increasing the yield of the first product, and hence at the same time of decreasing the after-products, is at present that of a proper use of sulphurous acid in combination with other processes of syrup purification. Although sulphurisation of the juice is an old method of clarification, it has only quite recently been thoroughly perfected by eminent specialists, and anyone wanting to treat his juice with sulphurous acid will find in the results of their investigations a rich store of useful information.

A very instructive paper on the subject will be found in the "Zeitschrift für Zuckerindustrie in Böhmen," for April, 1899.

(2.) The Ranson Process.

It will suffice to merely mention this process, as its discussion forms a special part of the programme of the present meeting.

(3.) The Ozone Process.

In the March (1899) number of the "Zeitschrift für Zuckerindustrie in Böhmen" and in No. 11, 1899, of the "Oesterr.-ungar. Zeitschrift für Zuckerindustrie und Landwirthschaft" may be found a full report by Herr Andrlik on the ozone method as carried out by Verley.

Herr Andrlik had the opportunity of studying this method of clarification in the French sugar factory at Noyon during the last campaign.

The method is essentially as follows: Ozonised air is drawn through the juice (about 20° Bé), cooled to from 25° to 30° for two to four hours, compressed sulphurous acid gas is then passed through in the cold until the juice attains an acidity of 0·02%. Barium hydrate is then added until there is a slightly alkaline reaction, when the juice is boiled, filtered, and evaporated to masse-cuite.

The ozonised juice is said to boil easily, the masse-cuite to be short, light, with a touch of grey, and to give, when washed with steam in the centrifugal machine, a beautiful white sand sugar with an agreeable taste.

Andrlik calculates the cost of a factory with a daily working capacity of 2,000 metr. ctr. of beets at 56,500 frs. and estimates the increased yield of sugar at about 0·3%. In any case these two figures, cost of erection, and increase in yield do not balance each other, even when the advantage of beautiful, white, agreeable-tasted sugar is taken into consideration.

(4.) The various electrolytic methods.

A few of these methods, a detailed description of which may be found in our special journals, may be mentioned by name only, as positive results and figures as to yields are not given anywhere. These methods, even when carried out on a large scale here and there, have not yet passed the experimental stage. They are: the Say-Gramme Meigret, Baudry, Charitonenko and Baudry, and the Horsin-Déon processes; the combined ozone-electrolytic method of the Electrical Rectifying and Refining Co., of Philadelphia, and several others.

Dr. Claassen, in the "Centralblatt für Zuckerindustrie," 1899, page 507, discusses the electrolytic processes in general, and expects no practical results from these methods, whether as regards clarification or decolorisation of the juice.

I may be allowed on this occasion to mention the excellent paper of L. Battut on the "Use of electricity in the purification of the products of sugar manufacture," read at the Second International Congress in Paris, 1896, and published in Part VI. (1896) of the journal of this society.

(5.) The Harms Process.

This method was carried out experimentally by Löbbecke, during the last campaign, in the sugar factory at Brieg. According to a

report in the "Deutsche Zuckerindustrie," 1899, page 21, the manager of the Löbau factory, Herr Weiland, said :—"The method is based upon the obtaining of a pure diffusion syrup effected by the addition of a powder. This powder, finely ground and in a dry condition, is mixed, in the proportion of one half per cent. of the beet, with the fresh slices as they enter the diffusor. He visited the factory on Sunday morning, December 4th, 1899, after the diffusion working had stopped, and his observations had to be restricted to the results of the working as regarded the juice, the masse-cuite, and the slices.

Evidently a not insignificant improvement in the diffusion juice takes place, as is clearly shown in the fine juices and masse-cuites, the more so as this factory works without either animal charcoal or sulphurous acid, and only with lime-precipitation (1 to 1½%), and triple carbonic-acid saturation, but it must be allowed that the raw material at the disposal of the factory was excellent.

The quotient of purity of the masse-cuite was 94·4; the ratio between salts and organic non-sugars, 1 : 1·63 ; the sugar was of good quality; the clear, very smooth, after-product masse-cuite promised a good yield. The results of the process were said to be very satisfactory.

The powder added is, according to the patent (D.R.P. 95,447, June 2nd, 1896), a ferruginous clay, rich in quartz, and it can be used for raw as well as for purified sugar syrups, if they contain no free lime.

Of the methods of juice purification here mentioned, the first, rational use of sulphurous acid, has become almost universal. The second, the Ranson process, is likewise employed in some factories and the results obtained with it appear to be quite satisfactory. The ozone and electrolytic processes and that of Harms are still only in the experimental stage, even where carried out on a large scale.

II. Working up the green syrups by their re-introduction into the manufacture. (*a.*) Reintroduction of the green syrups during the manipulation of the juice. In this division are classed the methods of Böcker, Zscheye, Gebrüder Löblich, Mügge-Pfeiffer, Manoury, &c.

The Böcker Process.

Some three years ago a large company visited the Gröbers factory to inspect the method of Dr. Böcker, who manages the factory personally.

The green syrup from the first product is treated either with hydrochloric acid or aluminium sulphite to decompose the molasses-forming salts, heated, again rendered alkaline by the addition of milk

of lime; barium chloride is then added during continuous stirring and the whole heated to boiling. The syrup thus treated, which has now become less viscous, is periodically or continuously reintroduced into the first saturation. The clarification of the beet juice mixed with syrup is generally effected with 2% of lime in the first saturation and $\frac{1}{4}$% lime in the second saturation, and in the latter with addition of sulphurous acid.

According to the report of the D. Z. I. for 1899, page 663, the factories which have worked with this process are said to have obtained satisfactory results. The final product is said to be only 1·4% molasses with a quotient of 55. In spite of the figures so favourably presented and of the low cost of the plant, the adoption of this method is limited and has not been able to obtain a firm footing here in Austria, although several factories have tried it experimentally.

A detailed report on this method, as at present in use, and on the analysis of the individual products, may be found in the "Böhmische Zeitschrift" for 1899, page 407. The figures of the yield according to this method are said to be:—

Of 100 parts of sugar in the beets are obtained:

	Chemically pure sugar.
In raw sugar, I. product	86·80%
,, II. ,, ...	3·69%
,, III. ,, and molasses ..	5·00%
Total..	95·49%
The resulting loss being ..	4·51%
	100.

Dr. Zscheye's Process.

The greater part of those who three years ago inspected the work of Dr. Böcker at the Gröbers factory also visited Dr. Zscheye at Biendorf to see his method of working. The aim of this method consists essentially in obtaining the purest diffusion juices, and in the conversion of the salts present in the juice and causing the formation of molasses, into such salts as do not dissolve more sugar than is taken up by water.

Reference may be made to the report of Herr Andrlik in the "Böhmische Zeitschrift" for 1898, page 65, and to that of Director Eger in the same journal for 1898, page 142.

At Biendorf, with two sugar products, the final molasses was only 15%.

Of 100 parts of sugar in the beets there were obtained:

	Chemically pure sugar.
In raw sugar, I. product	86·08%
,, II. ,, ...	6·43%
Total	92·51%
In the molasses or lost ..	7·49%
	100.

(3.) The Löblich Process.

The green syrups from the first product which have a minimum quotient of purity of 76, are, after previous preparation, reintroduced into the clarification process, and are worked up with dry clarification.

The chief point is an elaborate clarification. For this purpose Gebrüder Löblich carry out the dry clarification in an apparatus of their own construction, as they consider the clarifying vessels of the ordinary construction, which do not ensure a thoroughly accurate working, as unsuitable for the purpose. The Löblich dry clarification apparatus is a trough about three meters long and one meter in diameter, open, and provided with a spiral shaped agitator, into which the requisite weight of dry lime (3% of the beets) is introduced; a regulated quantity of diffusion juice, previously heated to 90° C, flows over it, and at the same time the corresponding quantity of syrup is added from the reserve tank. After the juice in the first saturation has been brought to the desired alkalinity in the second saturation, about ½% of lime is added, and it is boiled and saturated. The further working is as usual.

The quantity of the green syrup added to the clarified juice is regulated according to the degree of purity of the "thick juice," and as a rule the addition amounts to 3% on the weight of the beets. Repeated experiments have shown that it is advantageous to maintain the degree of purity of the "thick juice" at 90; with this quotient the boiling is excellent and proceeds without any difficulty. The addition of the green syrup is also made to agree with this quotient of the thick juice, and this is finally, so to speak, the regulator for the whole of the working.

The cost of the plant, according to Löblich's estimate, is very low, and for a daily working of 5,000 metr. ctr. of beets does not exceed 5,000 marks. The royalty amounts to two pfennige per meter centner of beets worked up in a campaign. According to Löblich the product has a good appearance. The Klein-Wanzleben, Löbejun, Güstrow,

Rethen and other factories are working with to this method and are ready to give any information required.

Herr Löblich gives the yield by this method, as carried out at Klein-Wanzleben during the last campaign, as follows:—

Of 100 parts of sugar in the beets were obtained:—

			Chemically pure Sugar.
In raw sugar, I. product		.. ..	83·4%
,, II. ,,		.. ..	5·2%
,, III. ,,	and molasses	.	6·3%
	Total..	.. . .	94·9%
	The resulting loss being	..	5·1%
			100.

(4.) The Mügge-Pfeiffer Process.

The green syrups from the first product, which must have a quotient of purity not lower than 72, are made alkaline with milk of lime and added to the diffusion juice before heating, so as to prevent any inversion. The quantity of syrup to be added should be from 3 to 4% on the weight of beets. Syrups with a quotient under 72 are simply evaporated in the ordinary manner. The entire quantity of the evaporated second-product masse-cuite is said not to be much over 2%, and to crystallize excellently within a short time.

(5.) The Manoury Processs.

This method of reintroduction of the green syrups into the diffusion process is of historical interest only, and is mentioned here merely to complete the list.

(*b.*) Reintroduction of the green syrups during the boiling.

(1.) The Wulff Process.

Under date July 29th, 1890, Dr. Ludwig Wulff, of Schwerin, obtained a patent for a method of continuous working up boiled juice to grain, which may be described as follows:

(*a.*) The centrifugalled syrup is drawn, without dilution, into a vacuum pan, along with powdered crystals from the previous boiling of the same product, after the introduction of the "thick juice" and of the boiling grain (gradually becoming dense) has ceased.

(*b.*) As soon as the accumulation of dilute syrup becomes too great, a portion of it, after the fine crystals have settled, is removed from the continuous working and boiled up into after-product, whilst the deposit at the bottom is employed in the process as given above.

The complete description of the process is to be found in the specification of the patent.

2. The Stenzel Process.

The syrup running off from two boilings of "pure" juice is diluted with thin juice of the second saturation (about 45% of the runnings) sufficient to give the mixture a concentration of about 50 Bx. To this are added 3% lime (calculated on the green syrup) in the form of milk of lime, and the mixture is boiled energetically for 10 to 20 minutes, then saturated with carbonic acid until the degree of alkalinity is 0·10, filtered and saturated with sulphurous acid until the alkalinity is 0·05 and then again filtered. The green syrups thus purified are mixed with equal parts of thick juice, and this mixture is used for introduction into the so-called mixed boiling, after grain has previously been formed with pure concentrated juice.

The green syrups from the mixed boiling are removed and boiled in the ordinary way to second or even third product.

The expense of installation is very moderate.

Mr. Stenzel had nearly all the requisite vessels and filters on hand in his works at Eichenbarleben, so that there was only the cost of setting them up, amounting to about 1,500 marks.

The patent royalty is one pfennig per 100 kg. of beet worked up in the campaign in which the method is employed. Representatives for this process are Gebrüder von Riessen, Berlin.

The following factories in Germany are working with this method: Eichenbarleben and Züttlingen (in Württemburg), and Söllingen (Braunschweig). In the next campaign an essential improvement will be added, which will permit the boiling of the clarified green syrup to grain without the addition of thick juice.

Mr. Stenzel calculates the following yields for the last campaign in Eichenbarleben.

Of 100 parts of sugar in the beets was obtained :—

	Chemically pure sugar.
In raw sugar, I. product	79·1%
,, II. ,, ...	5·7%
,, III. ,, ...	2·4%
Total	87·2%
In molasses	5·1%
In all the saleable products	92·3%
Loss	7·7%
	100.

(*To be continued.*)

MODERN POLARISCOPES.

By Geo. Stade, Berlin (B.P.A)—C. 2.

Second Article.

Referring to the article of Mr. Bruhns in the August number of this journal, concerning a new adjustable polariscope with the scale engraved on the quartz-wedge itself, Dr. F. F. Martens has favoured me with a detailed essay* on the merits of this new construction. The learned doctor, who is a thoroughly competent authority on these optical questions, sums up somewhat as follows :—

1. The proposed new division on the quartz-wedge itself is not feasible; or at any rate very difficult to arrange in the case of the double quartz-wedge compensation system, such as is described in my former article in the February number of *The International Sugar Journal*, pp. 67, 68 (figures 2 and 3.) These most improved types of modern polariscopes are indispensable for high class laboratories connected with the sugar trade, in the factory, and at experimental stations, as besides a full control of the whole length of the scale they also permit the reading of left polarization from 0° to 100°, which is particularly useful in analysing sugars containing raffinose, for inverted sugar and distillery purposes, etc. In fact, in combination with the new Patent Quartz-Wedge Fittings (which, according to Prof. Dr. H. W. Wiley's investigations, are indispensable for all very changeable climates, and particularly so for the tropics) these "Standard Polariscopes" still remain, up to now, the best in the market.

2. The advantages claimed for the engraved wedge construction, *i.e.*, that the relative changes of the scale as well as the relative shifting of the scale and wedge are avoided, are, *practically speaking*, valueless, as such changes do not produce the slightest influence on the correctness of the polariscope, so long as both wedges and scale are properly fitted in, and no pressure is exerted on the quartz-wedges owing to variation of temperature, and this is the case with all my "Standards."

3. Nevertheless, *all* polariscopes have to be constantly checked, no matter of what construction they are (and the engraved quartz-wedge ones form no exception to the rule), *firstly*, because, as Dr. Martens says, the absolutely correct normal-weight has not yet been satisfactorily fixed and settled with the highest scientific accuracy, but also, *secondly*,

* We expect to give this article in full next month.—(Ed. *I.S.J.*)

for practical reasons, all polariscopes being such complicated and delicate instruments that a complete check over the entire scale will remain of vital importance to all responsible and conscientious investigators, who will always feel bound to satisfy themselves by means of control tubes, standard quartz-wedges, and standard sugar solutions that not only the zero and hundred points but the whole of the readings of the polariscope are reliable and correct.

QUEENSLAND.

Results of Working in Central Factories.

(Continued from page 464.)

The report of the Moreton Central Sugar Mill Co., Ltd., is for the year ending 31st December last. This factory, which started work about five years ago, has had to be taken over by the Government, owing to the Company being unable to find the money to complete the necessary tramways, the building of which was a condition attached to the Government loan.

The mill commenced work on the 10th August, 1898, and finished crushing on the 6th January of the present year.

	1898		1897
	Tons.		Tons.
Quantity of cane crushed	11,490		7,553
,, sugar made..	1,192$\frac{3}{5}$		752
	Tons Cwt. Qrs.		Tons Cwt. Qrs.
Quantity of cane per ton sugar..	9 12 2$\frac{1}{2}$	..	10 0 3$\frac{1}{2}$
,, ,, ,, ,, (88%).. ..	9 6 3$\frac{3}{4}$	..	9 12 3
,, firewood to 1 ton sugar....	1·02 cords.	..	1·43 cords.
Average test of sugar sold	90·79	..	91·78
	£ s. d.		£ s. d.
Cost of cane per ton at mill	0 11 8	..	0 10 6
Cost of sugar per ton, including Government interest and maintenance ..	9 16 5$\frac{1}{2}$	..	—
Average price obtained, including 9s. per ton freight, and expected bonus of 10s. 6d.	9 4 7	..	9 13 0

The Government interest amounted to £1,366=£1 2s. 10$\frac{3}{4}$d. per ton.

The report of the Isis Central Mill (second years' working) is for the year ending 13th February. The season appears to have been very successful, and is highly creditable to the management, especially considering that owing to the large proportion of cane from virgin land and the wet and sunless summer and autumn, the mill was

working with raw material of low density and defective purity. Government interest for 13 months, amounting to £1782, was paid up to the end of June, 1898.

	Tons.
Quantity of cane crushed	32,665
,, sugar made	3,338
,, ,, (88%)	3,434
,, cane per ton of sugar	9·75
Average net test of sugars	90·81

	£	s.	d.
Cost of cane per ton at mill..	0	10	$5\frac{3}{4}$
Cost of sugar per ton including Government interest and all expenses but depreciation	6	11	$6\frac{3}{4}$
Cost of sugar per ton including Government interest and all expenses, and also depreciation	7	4	7
Price obtained for sugar per ton	8	13	1
Net profit on season's working	4073	9	1

This includes an estimated bonus on sugar amounting to £1612.

The Gin Gin Central annual report for the year ending 17th March, informs us that a large quantity of cane had to stand over owing to stoppages due to breakages in the machinery. Government interest (amounting to £2256) for the year ending 30th June, 1898, was paid, and it is hoped to reduce the principal somewhat during the 1899-1900 season.

Quantity of cane crushed	40,507·8
,, sugar made	3,897·26
,, ,, (88%)	4,147·4
,, cane per ton of 88% sugar..	9·76

	£	s.	d.
Cost of cane per ton at mill	0	9	$8\frac{5}{8}$
,, sugar including Government interest and all expenses but depreciation..	7	3	$9\frac{1}{2}$

The *Sugar Journal and Tropical Cultivator* gives the following very useful synopsis of the work and results during the season of 1898 at the Central Factories erected under the "Sugar Works Guarantee Act of 1893-95." In these tables the calculations of mill losses, &c., excepting at two mills, are not strictly accurate, and are inserted to show how valuable this information could be made for the mills, were chemists employed at every one, and the same system of analyses carried out. Percentages of sugars are also inaccurate owing to syrup and liquor sugars being mixed and branded No. 1, &c.; jelly sugars, No. 2. Under the account of working expenses are charged, expenditure incurred for maintenance of machinery, tramways and rolling stock, and general expenses having no definite account, such as travelling expenses, &c. In the case of average return per ton sugar, the bonus is included at 10s. 6d. per ton.

Particulars.	Marian.	Pleystowe.	Plane Creek.	Proserpine.	Mulgrave.	Mossman.
Capital under "Sugar Works Guarantee Act"	£39,000	£35,500	£65,000	£54,000	£56,000	£76,000
Advances made to date on Account of above	£37,000	£35,472 1 3	£64,182 2 10	£51,850	£43,484	£61,396
Size of mill rollers. Double crushing plant	54in. × 23in.	66in. × 34in.	60in. × 32in.	72in. × 34in.	54in. × 28in.	72in. × 32in.
Capacity of mills. Tons sugar per season	4,000	5,000	5,000	6,000	5,000	6,000
Miles of permanent tramway	12½	6½	22	9	7½	14
,, portable ,, ...	1	9	3	3	6	6
Number of cane trucks	300	375	400	200	300	500
,, locomotives in use	1	....	2	1	2	2
Commenced crushing	20-7-98	25-7-98	28-7-98	10-8-98	15-7-98	14-7-98
Ceased ,, ...	23-12-98	3-12-98	4-1-99	15-11-98	25-1-99	5-12-98
Shifts worked	2	2	2	1	2	2
Total hours crushing	2,152·9	1,246·	1,772·	581·	2,779·	2,399·
,, lost	359·	315·	571·	209·	497·	488·
Total tons of cane crushed	31,642·8	25,004·	30,159·5	12,344 7	37,552·	33,364·
Average tons cane crushed per hour	14·7	20·	17·	21·2	14·5	17 4
Total tons sugar made. 88 net titre	4,076·3	2,887·	3,416·5	1,555·	4,273·3	3,998·
Tons cane per ton sugar ,, ...	7·7	8·6	8·7	7·9	8·7	8·3
Tons firewood per ton sugar ,, ...	1·2	1·1	1·9	0·96	1·3	1·4
Average net titre of sugar made. No. 1	95·29	95·54	92·33	96·03	94·94	95·28
2	92·55	83·48	84.96	87·56	86·54	90·35
x	80·71	73·55	70·87	80·52	69·09	79·06
,, ,, of all sugars	93·60	91·61	88·81	93·13	89·78	93·10
Percentage of first sugar made	72·4	70·16	67·3	70·85	69·13	68·27
,, syrup ,, ...	20·2	26·09	21·9	23·02	16·22	26·27
,, jelly ,, ...	7·4	3·75	10·8	6·13	14·65	5·46
Percentage cane sugar in cane (average)	15·06	....	No. data.	15·4	14·2	14·5
Total tons cane sugar introduced into mill	4,705·	....	....	1,901·08	5,344·8	4,837·7
,, ,, obtained	4,091·	....	....	1,532·6	4,011·7	3,652·9
,, ,, lost in manufacture	674·	....	....	368·4	1,333·1	1,184·8
Percentage of mill losses. Determined	7·33	....	....	....	....	....
Undetermined	6·86	....	....	....	....	....
Total	14·19	....	About 30%	19·3 %	25 %	20·4 %
Area of cane crushed. Acres	2,164·	....	1,500·	830·	1,515·	2,248·
Number of cane growers	112	61	80	70	54	70

Particulars.	Gin Gin.	Mt. Bauple.	Isis.	Moreton.	Nerang River.	Totals.
Capital under "Sugar Works Guarantee Act"	£50,000	£32,560	£39,000	£33,000	£21,500	£501,500
Advances made to date on account of above	£50,000	£31,280 16 1	£37,433	£32,864	£19,998 18 10	£464,981 14
Size of mill rollers. Double crushing plant	54in. × 28in.	54in. × 28in.	54in. × 28in.	54in. × 26in.	48in.×24in.	....
Capacity of mills. Tons sugar per season	4,000	4,000	4,000	3,000	2,000	48,000
Miles of permanent tramway	18	$3\frac{1}{2}$	6	$9\frac{1}{2}$	7	$115\frac{1}{2}$
" portable	....	3	3	3	....	37
Number of cane trucks	4,000	110	262	118	125	3,090
" locomotives in use	2	....	....	....	....	10
Commenced crushing	14-6-98	11-8-98	9-8-98	10-8-98	23-7-98	....
Ceased "	30-1-99	4-12-98	1-1-99	6-1-99	12-12-98	....
Shifts worked	2	1	2	1	1	....
Total hours crushing	2,393·	1,051·	2,144·	1,059·3	No data.	....
" lost	775·	173·	266·	100·1	....	....
Total tons of cane crushed	40·508·	15,219·6	32,665·4	11,467·	12,706·	282,632·
Average tons cane crushed per hour	16·9	14·4	15·4	10·7	....	....
Total tons sugar made 88 net titre	4,103·5	1,767·5	3,440·	1,234·	1,357·	32,132·
Tons cane per ton sugar "	9 8	8·6	9·5	9·3	9·3	8·7
Tons firewood per ton sugar "	1·19	1·3	1·01	1·9	....	....
Average net titre of sugars made No. 1	94·03	93·80	92·95	95·41	....	....
2	89·16	91·31	87·77	82·25	....	....
x	71·86	63·59	66·10	72·05	....	....
" " of all sugars	92·61	88·9	90·66	91·03	95·3	....
Percentage of first sugar made	89·5	77·2	88·7	73·8	....	....
" syrup "	5·2	7·4	3·2	17·	....	....
" jelly "	5·3	15·4	8·1	9·2	....	....
Percentage cane sugar in cane (average)	No data.	13·96	12·63	No data.	13	....
Total tons cane sugar introduced into mill	....	2124·65	4,125·7	....	1,651·7	....
" " " obtained	....	1,831·60	3,200·	....	1,217·	....
" " " lost in manufacture	....	293·05	925·7	....	434·7	....
Percentage of mill losses. Determined	....	8·99	....	....	....	....
Undetermined	....	4·78	....	....	....	....
Total	About 27 %	13·7	20·9	....	25·5	....
Area of cane crushed. Acres	1,782·	750·	1,60 ·	567·	1,084·	17,060.
Number of cane growers	65	53	62	104	36	767

Cost of Manufacture.	Marian. £ s. d.	Pleystowe. £ s. d.	Plane Creek. £ s. d.	Proserpine. £ s. d.	Mulgrave. £ s. d.	Mossman. £ s. d.
Salaries Crushing season only	245 12 11	260 10 0	294 1 8	476 4 3	607 11 10	848 14 7
Wages do.	2467 0 7	1879 12 11	2006 3 0	1239 1 7	4019 14 9	2221 4 0
Firewood do.	1389 11 5	839 7 10	1587 19 0	639 18 0	1567 10 4	1596 17 6
Mill Supplies do.	795 6 3	877 12 5	520 11 6	473 16 0	837 10 8	342 6 10
Rations do.	675 2 7	498 14 5	848 2 10	....	787 16 4	757 15 6
Horse Feed do.	40 14 11	45 0 0	32 9 4	18 8 8	71 10 10	42 0 0
Total	5613 8 8	4380 17 7	5289 7 4	2847 8 6	7891 14 9	5808 18 5
Cane Purchased	20601 14 7	17216 15 3	16595 14 1	7400 5 1	18346 19 6	15015 8 4
„ Haulage account, carts and trams	640 5 10	503 9 4	1706 9 5	470 12 11	840 6 9	1161 10 6
Total	21242 0 5	17810 4 7	18302 3 6	7870 18 0	19187 6 3	16176 18 10
Salaries off season	249 0 0	303 0 0	234 19 4	272 12 4	218 10 1	598 13 2
Working expenses	1155 16 4	906 17 2	1027 11 6	926 18 6	1114 13 11	1842 12 5
Sugar charges	1350 2 1	868 11 10	630 1 0	138 14 10	1179 2 11	546 12 4
Office expenses	33 18 0	35 11 0	63 9 11	37 7 1	87 0 6	69 6 8
Insurances	94 13 0	85 13 7	122 10 0	135 13 3	144 11 9	69 15 9
Directors' fees	55 15 0	....	50 0 0	112 9 8	87 10 0	141 10 0
Auditors' fees	....	....	21 0 0	4 4 0	14 12 0	15 0 0
Legal expenses	85 2 0	....	159 5 6	55 0 0	85 14 2	370 13 7
Printing and advertising	32 2 3	14 15 7	21 10 0	12 4 3	31 12 3	62 11 6
Interest	104 17 9	25 16 7	147 2 4	41 11 11	228 12 9	313 1 2
Government interest	1845 12 6	1520 3 7	2117 9 11	2145 6 2	1800 0 0	2149 8 7
Total	5006 19 7	3760 8 2	4594 18 8	3882 2 0	4992 0 4	6209 5 2
Grand Total	319032 8	25951 10 4	28186 9 6	14600 8 6	32071 1 4	28195 2 5
Depreciation written off	1505 11 6	1924 16 6	2704 0 6	....	....	2052 18 0
Cost of manufacture per ton sugar 88 n. t.	1 7 1	1 10 4	1 10 8½	1 16 7¼	1 16 11½	1 9 0¾
Cost of cane per ton at weighbridge	0 13 5	0 14 3	0 12 1½	0 12 9	0 10 2½	0 9 8¼
Cost of haulage and cartage per ton cane	0 0 5	0 0 5½	0 1 1¼	0 0 9	0 0 5¼	0 0 8¼
Cost of cane per ton sugar 88 n. t.	5 4 4½	6 3 4½	5 6 2½	5 1 2¼	4 9 9½	4 0 11
Total cost of sugar f.o.b. at port „	7 16 9	8 19 9½	8 3 3¼	9 7 9½	7 10 1¼	7 1 0½
Average return per ton sugar „	8 10 6¼	8 9 6½	8 3 0¼	8 10 6	8 7 10½	7 10 6
Profit per ton sugar „	0 13 9¼	....	....	....	0 17 9¼	0 9 5
Loss per ton sugar „	....	0 10 3	0 0 3	0 17 3½	....	....
Total profit on season's operations ex. depre	2800 13 4	....	....	....	4047 16 5	1889 0 10
Total loss „ „ „	....	1478 5 0	70 19 3	1344 1 0	....	....
Total Government interest paid to date	4235 13 11	3561 13 0	500 0 0	....	2732 5 8	738 11 10
Liabilities, Interest to 30—6—99	1979 9 6	1662 2 2	7663 2 11	5582 3 3	1884 4 0	4757 18 4
Redemption „	6060 1 6	5432 0 0	8498 16 4	5092 10 0	4074 0 0	5092 1 0

Cost of Manufacture.	Gin Gin.	Mt. Bauple.	Isis.	Moreton.	Nerang River.	Totals.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Salaries Crushing season only	288 5 0	310 2 0	363 6 6	308 9 2	152 12 0	....
Wages do.	2686 19 0	1610 17 5	1893 8 0	977 7 5	1537 7 11	....
Firewood do.	860 3 1	365 0 6	612 14 11	356 2 6	533 3 9	....
Mill Supplies do.	427 19 8	519 3 10	197 7 7	207 7 6	733 14 10	....
Rations do.	738 9 9	....	....	280 18 0	144 11 5	....
Horse Feed do.	....	19 1 5	45 8 10	....	....	....
Total	5001 16 6	2824 5 2	3112 4 10	2130 4 7	3101 9 11	48001 16 3
Cane Purchased	16539 3 7	6146 11 2	13435 18 3	5357 6 9	6882 0 8	....
,, Haulage account, carts, and trams	2705 7 11	1580 11 9	2708 8 2	882 17 7	787 2 6	....
Total	19244 11 6	7727 2 11	16144 6 5	6240 4 4	7669 3 2	159814 19 11
Salaries off season	179 8 0	123 14 3	204 14 10	249 14 0	138 12 0	....
Working expenses	1249 16 0	304 14 7	492 17 2	639 1 9	391 3 6	....
Sugar charges	1410 2 9	444 6 11	230 16 6	679 9 5	355 3 4	....
Office expenses	34 12 7	48 14 8	35 5 8	47 6 5	11 1 1	....
Insurances	139 19 3	92 7 3	86 10 1	64 2 0	55 18 2	....
Directors' fee	50 0 0	60 0 0	....	100 0 2	25 0 0	....
Auditors' fee	10 10 0	2 2 0	25 4 0	4 4 0	3 3 0	....
Legal expenses	193 9 0	46 2 9	21 10 0	2 12 6	39 13 3	....
Printing and advertising	11 10 0	15 7 6	9 17 0	14 16 6	12 10 0	....
Interest	37 8 10	126 2 4	251 17 7	39 12 11	92 7 7	....
Government interest	2256 13 10	1470 7 2	1782 9 6	1459 6 2	999 19 0	....
Total	5573 10 3	2733 19 5	3141 3 6	3298 5 10	2124 10 11	45317 3 10
Grand Total	29819 18 3	13285 7 6	22397 14 9	11668 14 9	12895 4 0	253134 0 0
Depreciation written off	1799 14 0	1242 7 10	2245 13 11	....	....	....
Cost of manufacture per ton sugar 88 n. t.	1 4 4½	1 11 11½	0 18 1	1 14 6¼	2 5 8½	1 9 10½
Cost of cane per ton at weighbridge	0 9 6	0 10 2	0 9 10¾	0 10 10½	0 12 0¾	0 11 3¾
Cost of haulage and cartage per ton cane	0 1 4	0 2 1	0 1 8	0 1 6½	0 1 2¾	....
Cost of cane per ton sugar 88 n.t	4 13 9½	4 7 5¼	4 13 10¼	5 1 1½	5 13 0½	4 19 5¼
Total cost of sugar f.o.b. at port ,,	7 5 4	7 10 4½	6 10 2¾	9 9 1¼	9 10 0¾	7 14 5¼
Average return per ton sugar ,,	8 13 8	8 4 8¾	8 8 1	9 0 6½	9 12 1¾	8 9 5
Profit per ton sugar ,,	1 8 4	0 14 4¼	1 17 10¼	....	0 2 1	0 14 11¾
Lost per ton sugar ,,	....	....	....	0 8 6¾	....	....
Total profit on season's operations ex. depre	5810 0 5	1273 19 8	6514 11 9	....	142 5 11	22478 8 4
Total loss ,, ,, ,,	....	....	....	528 19 11	....	3122 5 2
Total Government interest paid to date	3420 7 3	2329 0 11	1647 16 9	350 7 4	839 0 0	20354 16 8
Liabilites, Interest to 30—6—99	3494 7 7	2251 10 8	1789 9 0	2958 12 7	2418 4 8	36445 4 8
Redemption	7582 3 4	4724 14 2	3225 5 0	2942 6 8	3536 9 2	56260 7 2

RUSSIA.

The Rise and Progress of the Sugar Industry.

At the annual meeting of the Russian sugar manufacturers, held at Kieff some years ago, the well-known statistician, M. Tolpygin (who has lately issued his eighteenth yearly report), delivered an historical address on the development of the sugar industry in Russia, a summary of which appeared in the *Journal des Fabricants de Sucre* shortly after. At that time we had intended to give a translation of this article, but owing to want of space it got overlooked. In view, however, of the steady increase in the Russian production and the advance which it is making in the markets of Persia and other neighbouring countries, together with the fact that the existing factories are not working to the full extent of their possible output (calculated at 54,000,000 poods against 39,581,542 poods actually made in 1897-98), it seems advisable to repair the omission and present our readers with the translation in question. The Russian pood is equal to about 36 English lbs., and 1,000,000 poods are equivalent to about 16,370 metric tons.

The founder of the sugar manufacture in Russia was General Yegor Ivanovitch Blankennagel, who about a hundred years ago obtained from a Magdeburg journal some data respecting the production of beet sugar, and decided to make some experiments in beet cultivation on his estates. After overcoming many difficulties he set up the first beet sugar factory in the village of Alabyeff, in the government of Toula. The factory was the only one in existence up to 1809, and it was only from that date that other large landed proprietors began to interest themselves in the new industry and to erect factories. About that time also the well-known proprietor of the Briansk machinery works became a manufacturer of sugar, and introduced several improvements. It is noteworthy that the first sugar factories were set up the central provinces of Russia, but as they were not particularly prosperous the industry commenced to take root in the western provinces, and it is only of late years that the industry has shown a tendency to return to the locality of its first origin. Towards 1840 it passed to the south, where it became definitely implanted.

Up to about 1860, the sugar factories were set up exclusively by the *pomestschiki* (proprietors cultivating their own estates), but after

the emancipation of the serfs other classes and shareholding companies began to occupy themselves with the industry, and a large portion of the works started by the the *pomestschiki* passed into the hands of such companies. Of the entire number of the works at present (1894) in operation, 79 factories and 9 refineries belong to companies, and 146 factories and 9 refineries to private individuals.*

The first factories were constructed in a very primitive manner and at very little cost. According to information furnished by M. Chichkoff, there were in 1855 works still in existence the expense of setting up which had not exceeded 1200 to 1500 roubles. As to working capacity, we can judge of this by a sentence which occurs in the *Histoire de la Société d'Agriculture de Moscou*, to the effect that "in 1835 Count Brobrinsky set up in the province of Toula a very important factory which could work up daily as much as 400 berkowetz"—about 65½ tons—while to-day there are some which are capable of dealing with as much as 6,000 berkowetz per day.

At one time there were numerous factories the annual output of which did not even reach 500 poods of sugar. According to information gathered by the Ministry of Finance for the year 1848, the productive power of the then existing works was as follows:—Above 15,000 poods, 6; between 15,000 and 10,000 poods, 11; between 10,000 and 5,000 poods, 70; between 5,000 and 3,000 poods, 78; between 3,000 and 1,000 poods, 172, and 43 producing less than 1,000 poods; in all, 380, with a total production of 1,195,000 poods.

Later, in 1858, 380 factories turned out 2,438,842 poods; in 1886, 300 factories gave a total production of 6,840,700 poods; in 1881, 234 factories made 15,994,390 poods; finally, in 1893-94, the 225 factories at work will turn out about 35,400 poods (say 580,000 metric tons).† These figures show that in the course of the last 46 years the average production of the Russian factories has increased fifty fold.

In 1881 (it is only from that year that we possess accurate statistical data), the Russian factories worked up on an average 972 berkowetz (of 164 kilogs.) per day; in 1893, the average daily figure reached 1,772 berkowetz. As to the manufacturing yield, in 1800 they got

* At present (1898-99) the proportions are about as follows:—

	By Companies.	Private.
Refineries	11	7
Factories	100	155

Of the 155 factories which are owned by private individuals, about 23 are leased to companies.—Ed. *I. S. J.*

† Licht gives 658,070 tons for that campaign.—(Ed. *I. S. J.*)

from one berkowetz of beets (the berkowetz in this case = 12 poods or 197 kilogs.), about half a pound (Russian foont =400 grammes) of sugar; in 1830, it amounted to six pounds; in 1848, to 18 pounds; in 1881, to 35 pounds; in 1891, to 51 pounds, and finally there are at this day (1894), works where the daily *rendement* reaches 62 pounds of white sugar from one berkowetz.*

Up to 1848, the manufacture of sugar in Russia was exempted from taxation. But in that year a tax† was levied of 20½ copecks per pood; in 1863, 30·6 copecks; in 1868, 30·4 copecks; in 1872, 32·1 copecks; in 1881, 1883, 1886, and 1889, 50, 65, 85, and 100 copecks respectively; in 1893, the tax was one rouble for sand sugar, and 40 copecks for refined; finally, in 1894, one pood of sand sugar pays 1r. 75c.

Foreign sugar always paid duty. This was, per pood:—

1807.	1811.	1814.	1822.	1831.	1842.
1r. ..	1r. 80c. ..	75c. ..	2r. 25c. ..	2r. 80c. ..	3r. 80c.

In 1857, the duty was 2r. by land and 3r. by sea; in 1863, 2r. 50c. by land and 3r. by sea; in 1886, on sand sugar by land, by the Black Sea and the Sea of Azoff, 2r.; on refined, by the Black Sea and the Sea of Azoff, 2r. 90c., and by land or other sea borders, 2r. 90c.

From 1800 to 1893, the total production was 491,112,279 poods, of which 3,478,528 was untaxed. The sugar consumption during that period was 452,841,049 poods. Since 1881, there have been exported, free of duty, 38,271,230 poods. The quantity of sugar imported during the same period, was 74,468,291 poods.

Some further statistics were given by M. Tolpygin, relating to the fuel (wood) consumed, and the number of days required for the production of a given quantity of sugar, but they do not appear worth reproducing.

The 18th annual report (1897-98) on the Russian sugar manufacture contains the following details:—

Number of factories at work, 237. The area sown with beets was 367,439 desyatines, 64 per cent. being by farmers for sale to the factories. The quantity of beets harvested was 36,878,685 berkowetz, the crop average being thus 1,004 poods to the desyatine. Turned into

* Presumably of 12 poods.—(*Ed. I. S. J.*)

† This is the tax still in force.—(*Ed. I. S. J.*)

English weight and measure, this means a crop of 5,980,362 tons (2,240 lbs.) from 1,010,452 acres, or nearly 6 tons to the acre. The extraction was 107·7 poods of sugar per desyatine, equivalent to about 1,413 lbs. per acre.

The average polarisation of the juice was 14·91%, and the purity 82·83.

The production was :—

	Poods.		Cwts.
Refined Sugar	4,662,404	..	1,503,446
White Crystals and Lumps	34,671,807	..	11,180,326
Raw Sugar	359,983	..	116,081
Left behind in the low products	3,278	..	1,057
	39,697,472		12,800,910

The total production is stated at 39,581,542 poods, which does not quite agree with the above details. To this must be added the stock from the campaign of 1896-97, making a total of 47,287,936 poods. The quantity brought over into the 1898-99 campaign was 4,987,749 poods. The yield of sugar was 10·89 per cent.; molasses 3·95 per cent.

Deliveries.	Poods.		Cwts.
For home consumption	33.369,181	..	10,760,280
Exported to Western Europe	6,425,372	..	2,071,936
,, Asia	2,165,484	..	698,285

The sugar sent to Europe was exclusively crystallised. Eighty-one per cent. of that sent to Asia was refined.

UNITED STATES.

Tariff and Trusts.

Some surprise has been excited by the hostility to the existing tariff shown by Mr. Havemeyer in his examination before the United States Commission, and the apparent inconsistency of his position in making the statement that the tariff—meaning presumably the existing tariff—is " the mother of trusts." Some light on the question may be derived from the following extract from a New York journal, which is given by the *Sugar Planters' Journal*, under date 2nd September :—

" The American Sugar Refining Company, the sugar trust, makes its money on the difference between the cost of raw sugar and the

price of refined sugar. Every addition to this difference increases its profits. Every decrease in it lessens its profits.

"Under the Wilson tariff the yearly average net price of the standard grade of raw sugar (90 degrees of centrifugal), the price of granulated or refined sugar, and the difference between them per pound in cents was as follows:

	Raw.		Refined.		Difference.
1894	3·240	....	4·120	....	0·880
1895	3·270	....	4·152	....	0·882
1896	3·624	....	4·532	....	0·908
1897	3·557	....	4·503	....	0·946

"As will be seen, under the Wilson tariff, this gap steadily widened, and every increase must be multiplied by 3,000,000,000 pounds, which is the average annual meltings of the trust. The Dingley tariff came in in 1897, and this is what happened with the difference on which depended Mr. Havemayer's profits:

	Raw.		Refined.		Difference.
1898	4·235	....	4·966	....	0·730

The margin which Mr. Havemeyer raised to ·946 under the Wilson tariff shrank to ·730 under the Dingley tariff. This is a difference of ·216 of a cent. All by its self this is not very much out of your pocket. But if you are melting 3,000,000,000 pounds of sugar, and ·216 measures the decreased profits on each pound—then ·216, the reduction in the difference between raw and refined under the Wilson and under the Dingley tariffs amounts to $6,580,000. This is two-thirds of the dividend paid by the sugar trust and one-third of the profits which Mr. Theo. F. Havemeyer admitted the American Sugar Company made. After losing this in passing from a free trade to a protective tariff, it is natural for Mr. H. O. Havemeyer to discover that the "tariff is the mother of trusts." If it had been as kind a nursing mother to his trust under the Dingley as under the Wilson tariff, he would have been silent."

Imports of sugar into France from French colonies, 1st September, 1898, to 31st August, 1899, were 105,005 metric tons. Exports of French raw sugars during the same period were 98,578 metric tons (previous season, 186,230), and of refined sugars 81,082 metric tons (previous season, 69,921).

Austria-Hungary.

The report on the trade of the Austro-Hungarian Monarchy for 1898, drawn up by the Consul-General, gives some interesting details respecting the sugar industry, and it is evident that he has had access to good and reliable sources of information. The report was received at the Foreign Office on the 10th July, and it will be seen that the later and more definite official figures differ a little here and there, but not to any noteworthy extent. The following extracts comprise all that relates to sugar production, export, &c.

Value of total exports of sugar for two past years:—

1897.	1898.
£	£
5,115,180	5,587,957

Of these there went to Great Britain:—

	Bounty per 100 k.	1897.	1898.
	fl. c.	£	£
Class I.	1 50	59,810	46,966
,, II.	1 60	236,462	173,479
,, III.	2 30	2,779,078	2,388,583
		3,075,350	2,609,028

The quantity sent to this country in 1898 was 4,805,100 cwts.

The value of exports to British India for two years was:—

1897.	1898.
£	£
540,668	547,924

During the season 1898-99 there were 214 beet factories in Austria-Hungary engaged in the beet sugar industry. The total output of raw sugar during that period is estimated to amount to 1,024,000 tons, which quantity is almost equal to that produced during the season of 1894-95, when the total output reached 1,029,000 tons, the largest yet recorded. The entire area under beet cultivation in 1898-99 was 761,000 acres, whilst in 1894-95 the area was 929,000 acres. According to these figures the aggregate result in 1898-99 amounted to 27 cwts. of sugar per acre, as compared to 22 cwts. per acre in the season of 1894-95. The total quantity of beet grown in 1898-99 amounted to 7,494,000 tons, as against 8,398,000 tons in the season of 1894-95, which gives a yield of 192 cwts. per acre in 1898-99 as compared to 181 cwts. per acre in 1894-95. On the basis of the foregoing returns the total yield of sugar from the beet amounted to 13·6 per cent, in 1898-99, and 12·2 per cent. in 1894-95.

So far as concerns the beet harvest and the output of sugar alone, the past season can be classified as highly satisfactory. Nevertheless, from a financial point of view it was not so favourable, quotations during the entire season remaining at a low level. Thus the highest price attainable was about 11s. 2½d. per cwt. delivered at Aussig, which, however, declined to about 10s. 6d. toward the close of the year. At the beginning of 1899 a rise occurred, so that at the end of April 12s. 3½d. was quoted.

The prices ruling abroad for refined sugar were lower than usual, and in view of the quotations for the raw commodity were comparatively unremunerative. On the London market during the first half of the season quotations for foreign granulated sugar ranged from 11s. 2¼d. to 11s. 7½d. per cwt. Simultaneously with the advance in the price of raw sugar a rise took place, so that about 12s. per cwt. was recorded. The difference in price between raw and granulated sugar, which, at the commencement of the season, averaged about 2s. per cwt., declined later on to nearly one-half that figure.

The recent decision of the Legislative Council in Calcutta, to impose a countervailing duty on bounty-fed sugar imported into British India has caused much uneasiness in those circles in Austria-Hungary interested in the industry.

Divergent opinions are expressed as to the effect the new measure will have on the industry in general. In certain quarters it is thought that the exportation of refined sugar from Austria-Hungary will be detrimentally influenced by the imposition of a countervailing duty. On the other hand, however, it is contended that the new impost will scarcely be felt, and that a rise in the price of sugar for the Indian consumer will be the result. In this connection it is surmised that in view of the comparatively limited stocks held throughout the world the price of colonial sugar in future shipped to India will increase in proportion to the countervailing duty levied on bounty-fed sugar.

In consequence of the existing Convention to which all the Austro-Hungarian factories belong, domestic prices underwent no variations during the past season. The advance in the price of raw sugar, which recently occurred, likewise failed to influence the home market.

No change is to be recorded in the system of manufacturing in use in the various establishments in this country. During the year a number of attempts were made abroad to introduce new methods with a view to improving or facilitating the process of manufacture. The innovations were carefully studied in those circles interested in the

industry here, but none of them were considered sufficiently advantageous to warrant their adoption in Austria-Hungary.

At present the general tendency is to reduce rather than increase the number of factories engaged in the industry. In 1898-99 there were 214 factories at work as compared to 216 in the preceding season. The low and consistent retrogression in the price of raw sugar renders the existence of any but large establishments conducted on the most modern and economical lines a practical impossibility. With prices ranging on an average from 11 fl. to 12 fl. per metric cental, as has actually been the case for several years past, the competition of the smaller factories is precluded, handicapped as they mostly are by heavy working expenses.

Bosnia.

The imports of sugar during 1898 amounted to about 50,000 meter centner, = 4,921 tons. To this must be added the output of the Usora factory, over 30,000 meter centner, or 2,952 tons, giving a consumption of nearly 8,000 tons.

Persian Gulf.

Bushire.—Quantities and values of imports of sugar for the past two years:—

	1897.			1898.	
	Cwts.	£		Cwts.	£
Loaf sugar	56,376	59,342	...	36,752	30,550
Soft	22,225	15,020	....	55,178	39,421

The decline of import in loaf sugar, balanced by increase in that of the cheaper "soft" kind, is attributed to the poverty of the people. French sugar still keeps the lead, but Egyptian produce is beginning to be introduced.

Imports and values for the two past years at the following ports:—

	1897.			1898.	
	Cwts.	£		Cwts.	£
Lingah.—Loaf sugar ..	2,125	1,990	...	1,037	973
Soft ,, ...	4,500	3,656	....	4,400	3,300
Candy ,, ...	350	437	....	300	375
Bandar Abbas—Loaf sugar.	22,500	16,796	....	14,400	14,400*
Soft ,,	23,585	15,240	....	19,833	14,875
Candy ,,	432	432	....	488	519
Bahrain.—Loaf sugar ..	370	375	....	440	343
Soft ,, ...	4,100	3,716	....	4,850	3,473
Candy ,, ..	920	1,092	....	830	986

* This figure appears to be a mistake or an oversight.

	1897. Cwts.	1897. £		1898. Cwts.	1898. £
Mohammerah.—Loaf sugar	11,953	9,961	....	7,017	5,845
Soft ,,	4,760	3,563	....	5,198	3,977
Karun Port.—Loaf ,,	2,597	2,143	....	9,097	7,700
Soft ,,	2,040	1,530	....	3,804	2,870
Arab Coast.—Loaf ,,	....	125	....	....	188
Soft ,,	10,500	9,843	....	10,050	9,375
Candy ,,	...	25	...	....	31

Total value of all the sugar imported into the Persian Gulf :—

	1897 £		1898. £
Loaf	78,628	....	46,454
Soft	47,475	....	70,444
Candy	1,986	..	1,911

Of the sugar thus imported a certain amount was re-exported to unnamed ports, as follows :—

From	1897. Cwts.	1897. £		1898. Cwts.	1898. £
Bushire	482	495	....	1,226	946
Lingah	3,150	2,756	....	3,600	2,850
Bahrain	2,030	1,917	....	2,155	1,751

Reunion.

Exports and values of sugar for two past years :—

1897. Tons.	1897. £		1898. Tons.	1898. £
44,919	435,785	....	31,418	354,950

The output in 1891 was the lowest since 1893, and is attributed partly to drought, but partly to land being thrown out of cultivation owing to the scarcity of labour. "The Creole will not work more than is necessary to earn his living, and in Réunion life is so easy that he can easily earn in two days all he wants for the week." A petition has been numerously signed asking for the renewal of immigration from India as arranged in December 1897 between France and the United Kingdom, as the Indians working on the estates under indenture are yearly becoming fewer, and the planters are in despair.

Madagascar.

The British Consul says: "Sugar, although not a great success, is by no means a failure. It has been said that after a short time the fertility of the Madagascar soils begins to wane when planted with sugar cane, and needs to be artificially renewed, but this is the case

in other sugar-growing countries, notably (for instance) in Mauritius. Alcohol is distilled from the native sugar up to 85° (French).

Madeira.

The British Consul reports: "The cane crop in 1898 is roughly calculated at about 20,000 tons (about the same as last year), value £45,000, and of this about 11,000 tons were turned into sugar, yielding approximately 750 tons of sugar, which sufficed for the consumption of the island for about ten months, the deficit being imported about equally from London, Liverpool, and Hamburg. The remaining cane was turned into cane spirit, which is very largely drunk by the working class. About 800 tons of molasses were imported from British Guiana and Trinidad, but owing to the great advance in price in these countries it is now (1899) being imported from Hamburg (beet molasses) and from Cuba. This is all used for the manufacture of neutral spirit. Fresh species of cane are constantly being imported here by British residents, from Natal, Demerara, Mauritius, Australia, and other cane growing countries, but the great difficulty with the natives is to induce them to give the ground a rest or change the crops, and at present the same land has grown sugar cane for the last ten years, in addition to crops of potatoes, cabbages, beans, and maize."

Zanzibar.

Imports and values of sugar for the past two years:—

1897.		1898.	
Packages.	£	Packages.	£
15,388	14,924	23,512	26,630

In the absence of information as to the size of the packages, it may be surmised that they contain 100 kilos., or thereabouts.

China.

Kiungchow.—Exports and values of sugar for the past two years:—

	1897.		1898.	
	cwts.	£	cwts.	£
Brown ..	157,439	58,232	107,880	38,109
White ..	27,062	15,238	12,161	6,567

The decline in 1898 is very probably to be attributed to diminished production owing to drought.

Wuhu.—Imports and values of sugar for the past two years:—

	1897.		1898.	
	Cwts.	£	Cwts.	£
Foreign	113,452	58,064	121,771	67,235
Native (mostly white) ..	112,700	38,778	121,810	77,717

The increase is due to the great advance made since Wuhu became a treaty port. The distinction between "foreign" and "native" sugar is, with the exception that the former is manufactured in Hong Kong, a distinction without a difference, the only sugar found in this port in any appreciable quantity being grown in the southern provinces of China.

JAPAN (South Formosa).

Tainan.—Exports and values for the two past years:—

	1897.			1898.	
	Cwts.	£		Cwts.	£
Brown sugar ..	687,978	207,946	....	694,885	264,002
White ,, ...	82,532	45,804	....	98,098	60,117

The Consul remarks:—The amount of sugar exported in 1898 shows a considerable increase as compared with the amount exported during the previous year. The figures include sugar exported to Japan as well as that sent to foreign countries. A considerable portion of the export trade to Japan is, however, in the hands of foreign merchants at this port, and nearly the whole of the trade that went to Japan in 1898 was carried in British vessels. The export to China (chiefly to Ningpo and Tientsin) is exclusively in the hands of Chinese merchants, the powerful Guilds in the North of China effectually preventing any competition on the part of foreign merchants.

A new feature, however, in the trade is that, whereas formerly all the sugar from South Formosa to the North of China was shipped in junks, a considerable portion of the amount exported is now, in spite of comparatively high freights, taken over by steamers. With reduced freights, there would seem to be no reason why the whole crop destined for China (which last year amounted to over 330,000 piculs of 133⅓ lbs.) should not be shipped in steamers. A considerable saving in time would certainly be effected and the cargoes would be afforded better protection against sea-damage during the voyage.

The following table gives the amount of sugar exported from this port to Japan and to China and Hong-Kong respectively during 1898:—

	Japan.			China & Hong-Kong.	
	Quantity.	Value.		Quantity.	Value.
Kind of Sugar.	Cwts.	£		Cwts.	£
Brown sugar ..	392,229	144,108	....	302,656	119,894
White ,, ...	3,160	2,222	....	94,938	57,895
Total ..	395,389	146,330		397,594	177,789

The sugar crop for the year was above the average both as regards quantity and quality. The market opened early in February at

$3 30c. per picul (5s. 8d. per cwt.) for the ordinary grade of Takow sugar (brown), but gradually improved owing to a good demand in Japan, and purchases in June were made as high as $4 20c. per picul (7s. 2½d. per cwt.). As in the previous year Tainan brown sugars of superior quality found ready buyers in Japan, and the export again shows a considerable increase. The troubles in the Philippines restricted the export of sugar from those islands during the year, and doubtless materially assisted the position of Formosan sugars in Japan, but now that the superior grades of Tainan brown sugars have established themselves on the Yokohama market it is not unlikely that they will be shipped largely in the future in competition with Manila sugar.

The demand in Japan for Tainan brown sugars of superior quality considerably enhanced the price of these sugars. The high cost told against exporters to the Northern Chinese ports, and shipments, particulary to Tientsin, left little or no profit.

Tamsui.—Imports and values of sugar for the past two years:—

	1897.			1898.	
	Cwts.	£		Cwts.	£
White sugar ..	42,047	25,705	..	65,781	40,206

The bulk of this comes from the China Sugar Refining Company and the Taikoo Sugar Refinery, both of Hong-Kong.

Nagasaki.—Imports and values of sugar for the past two years:—

	1897.			1898.	
	Cwts.	£		Cwts.	£
Brown sugar..	93,474	40,233	....	119,456	54,268
White ,, .	247,340	170,486	...	522,518	370,329

A large part of this sugar comes from Hong-Kong, the whole of it being Eastern produce, a certain portion of it probably from Java. The large increase was owing to a prospective change in the customs duties.

Siam.

Bangkok.—Imports and values of sugar for the past two years:—

1897.			1898.	
Tons.	£		Tons.	£
6,292	62,316	....	5,213	48,768

The trade is almost entirely in the hands of two British firms. The principal import is from the two large Hong-Kong refineries. The raw sugar comes from Java, Formosa, the Philippines, and China. Molasses, not included in the above figures, comes from China.

Guatemala.

Exports of sugar increased from $1,802 (silver) in 1897, to $843,409 in 1898. The whole of this went to the United States.

EMIGRATION TO THE SUGAR COLONIES.

The return presented to the Government of Bengal of the emigrants despatched to the sugar colonies during 1898 affords some interesting information. The number of emigrants, thanks to increased prosperity amongst the agricultural classes and the prevailing cheapness of food stuffs, was somewhat less than in the previous year. The number registered was 9,334, as against 12,315 in 1897, while the number of actual emigrants was 9,034. In addition to the difficulty of recruiting, a falling-off in the demand from the various colonies is a strong reason for the decline in the number of emigrants. Only 6,358 were indented for last year as compared with 7,024 in 1897, and it is likely that the indents will continue to diminish in the absence of any immediate extention of sugar cultivation, a very improbable contingency, in the English colonies at any rate. The depression in the cane sugar industry is not, however, the sole cause of the smaller demand for Indian labour; the indents of the planters in Trinidad and Demerara are subject to severe scrutiny on the part of the Colonial Office, and, in the case of one colony at least, the original indent last year was cut down by about 30 per cent. before it reached Calcutta. Demerara continues to head the list of colonies importing Indian labour, the number of its emigrants last year being 2,301, Mauritius coming next with 1,358, and then Trinidad with 1,225. The number of emigrants who returned last year was 3,502, and their aggregate savings amounted to Rs. 4,75,087, the average per head being Rs. 125-10-7. Of this total, Demerara contributed the very large proportion of 1,558, who brought back average savings of Rs. 137-9-9. The largest average occurred amongst the returned emigrants from Fiji, namely, Rs. 229-13-10, and the smallest from Mauritius, Rs. 14-14-4. These averages, however, are not worth much, for, as is remarked in the Government Resolution on the Report, a great number of the returning emigrants reach Calcutta empty-handed. The Lieutenant-Governor of Bengal expresses some surprise at this fact, but the truth is that the most successful emigrants do not come back. The proportion who elect to settle in the West Indian colonies is particularly large, and in Demerara, where Crown land is obtainable on nominal terms, and where the emigrant now has to pay a third of his return passage money, the proportion of settlers will probably steadily increase in course of time. It is interesting to notice that

the Indians permanently domiciled in the colonies number considerably over a million souls. In Mauritius alone the Indian population amounts to 260,542; in Demerara to 116,633; and in Trinidad to 84,057. The Protector of Emigrants regards the position and prospects of the resident emigrants in Fiji and in the West Indian colonies as being most "favourable," and advantage is certainly taken of the opportunities presented by a great proportion of the Indians who go there. This means that the Indian labourer and agriculturist is displacing the negro on his own ground, and it is quite possible that in the course of another generation these Indian immigrants may form the most numerous aud important section of some of the largest of the British West Indian colonies.—(*Indian Agriculturist*, from a Lahore paper.)

JAVA.

Shipments of Sugar for Three Years (July to June).

Destinations.	1896-97. Metr. Tons.	1897-98. Metr. Tons.	1898-99. Metr. Tons.
To Holland, and for Orders	298,560 (To Holland, Great Britain, Marseilles, Port Said)	1,361	9,945
,, Great Britain		16,516	16,806
,, Marseilles for Orders		—	1,689
,, Port Said ,,		3,306	47,555
,, Azores ,,	—	11,759*	8,646†
,, Delaw. Brkwtr. for Orders	—	7,123*	84,339†
,, Barbados for Orders	—	9,735*	16,402†
,, America	62,232	263,721	293,390
,, Canada	—	7,016	3,031
,, Australia	18,726	32,453	2,534
,, China	102,066	150,452	154,533
,, British India	5,085	5,614	8,277
,, Japan	260	1,235	19.603
,, Singapore	18,213	30,039	24,130
,, Timor Deli	9	6	3
,, Singapore for Orders	1,855	—	—
	507,006	540,336	690,883

* All these eventually went to the United States.

† All these have probably since gone to the United States.

INDIA.

Proposal to Manufacture Jams, &c.

The paragraphs reproduced below, which are taken from *The Times of India*, have a special interest from two points of view, one of them being the prominence that has lately been given to the proposals to establish a jam industry in Germany and so use up some of their excess sugar production, the other, the idea that a fresh impetus might similarly be given to the Indian refining industry, which has been suffering from the competition of the Bounty-fed European beet sugar, and which needs all the encouragement that can be given in order to stimulate the native refiners to employ improved methods, without which they will, it is to be feared, not be able to make head, even with countervailing duties, against the superior quality and appearance of the imported article. There is all the more reason for us on this side the world, to wish well to the scheme for real Indian jam making, because there is room for any further quantity of novelties of the kind indicated without interfering materially with the sale of our own products, which it is improbable those of India could ever replace. The article is entitled

A Jam Industry for India.

Why do we import our jams and jellies? The development of the resources of India is a subject which has produced a rich crop of talk within recent years, and also a little action. Here and there an enterprising man has attempted to start a paper mill, or soap works, or some other novelty. In Bombay, we even have a cigarette factory. But most of these enterprises are of such a nature that the highest aim they can set themselves is to produce an inferior quality of some article with which the country is already amply supplied from Europe. In some cases the very materials must be imported. This is developing the resources of the country in a very limited sense. Why is no serious attempt made to produce a commodity which Europe cannot give to India, and India can give to Europe? The fruits of India are its own. There is no doubt room for difference of opinion as to their value. In the days of the Mutiny an honest Scotch woman, who had come out with her husband's regiment, prepared to hate the "blacks" and everything that belonged to them, gave her verdict on Indian fruits concisely and emphatically. "There's no one o' them fit to eat," she said, "but the banana, and it's like saft sape." More recently a globe-trotting divine compared the banana to "sawdust

and honey." But these estimates are not universal, to say the least. If mangoes and guavas and Indian plantains, red and yellow, and custard apples and pumaloes could be offered ripe and sound on the fruit stalls of London, almost any price might be asked for them· Witness the prices obtained for West Indian bananas of a quality which no Bombay butler would put on the saheb's table. Unfortunately, few fruits can bear the voyage from India to England. But many of the fruits of India are convertible into jams and jellies and preserves which only need to be known. It is superfluous to say anything in commendation of guava jelly, and mango chutney has established itself, but mango jelly is not so well known as it should be. Tipparee, or "cape gooseberry," makes a jam which is not surpassed by any that Europe can show. The Currunda, or Corrinda berry, which grows wild on all the hills of this Presidency, and is sold by old women on the roadside at a measure for a pice, makes a jelly as delicate as red currant jelly, and superior to it in flavour. Rozelle jelly is not quite so good, but it is very good, and so is rozelle jam. Citron marmalade is certainly superior to orange marmalade, and pumalo marmalade is as good. There are other fruits, not so well-known, the resources of which have never been properly tried. The kumruk, a golden-green fruit, the size of a plantain, but star-shaped in cross section, is known to comparatively few Englishmen, either by sight or name, but it has quite a unique acidity, and makes such a delicious stew, or tart, that there must be great possibilities in it for a skilful confectioner. We need not speak of tomatoes and tamarinds and rose-apples and papais and other fruits, which, though not equal to those named above, can be converted into delicacies not to be despised. But we must not confine our view to jams and jellies and preserved fruits. There are other preparations, chutneys, syrups, and especially pickles, for which the fruits of India are peculiarly well-suited. And in connection with pickles it may be noted that not only the materials, but the treatment might be a novelty at home. For the natives of India are adepts at pickling fruits, and have many domestic recipes totally different in character from any that are known in Europe. And, if we may judge by the samples that come in our way occasionally, as offerings from grateful subordinates, there is little fear that they would fail to please.

It is not improbable that many attempts have been made, of which no record remains, to establish manufactories of Indian preserves. Few are aware how full our history, even in this Presidency, has

been of enterprises which turned out like the grass upon the house-top, which withereth before it groweth up. The native is conservative, and the master is in the hands of his servants, so the difficulties which meet every attempt to introduce a novelty too often proved fatal. Old inhabitants can remember the time when we all ate the bread of obliging Goanese gentlemen, manufactured under conditions of filth which it is not wholesome to think of. A European bakery was started amid general joy, but in a very short time the bread deteriorated, and became so bad that the obliging Goanese gentlemen came into favour again. It did not occur to master or mistress that the butler might be interested in his countrymen, and could easily change the bakery bread for the worst in the bazaar. But Messrs. James Pearse and Company took to stamping their loaves, and by degrees the difficulties were overcome, and now good bakeries, where clean and wholesome bread is made, have secured a place from which they will never be dislodged. The dairies furnish a more recent and more wonderful example of a novel enterprise crowned with success. A very few years ago if any Englishman had the hardihood to try the butter offered at an hotel table in Bombay he was marked a griffin. In private houses the choice lay between making one's own butter and using the tinned article from Europe, oily and very salt. A person who would eat bazaar butter was *haramkhor*. But the dairy has suddenly come into being, and pure butter of excellent quality can be had of "all respectable dealers." And these examples, in spite of many failures, afford some ground for the hope that a manufactory for the production of India jams and jellies and dessert fruits and preserves of all kinds might meet with like success if started on right lines and carried on with enterprise. It may be said that there are some in existence now. Well, in a sense this is true. In many Indian stations there appear to be retired butlers and mess-men, in whose cells in the bazaar is elaborated a preparation called "Best Gowaver Jelly," with other distinguishable from it by the label more easily than by the flavour. And there are also a few old makers who have really established a reputation for Indian condiments. But these are like the dealers in Japanese curios. Their customers are eccentric people and epicures who affect curious and little known luxuries. They are also resorted to when we wish to send a grateful Christmas box to some retired uncle, who stands to us in what may be called a prospective testamentary relation. It is an expensive Christmas box, for these Indian condiments cost about

twice as much here as articles of the same nature imported from Europe. And here is, perhaps, the principal cause of their failure to come into general use. They will never do so even in India, still less become an article of export to Europe, until they meet on equal terms the foreign commodities which enter into competition with them. But it is difficult to see any reason why they should not easily do this. Fruit is ridiculously cheap in India compared with what it costs in England; sugar, *pace* Mr. Maclean, is surely cheap enough, and labour is notoriously so. And no very expensive machinery would be required. We see no reason to doubt that an enterprising man, with some talent for starting a new business and advertising it, might open up a new industry along the line we have indicated, with profit to himself, advantage to India, and pleasure to us all.

Correspondence.

The West Indian Crisis.—Fruit *v.* Sugar.

To the Editor of The International Sugar Journal,

It is very satisfactory to read the reports which are now so common of the great and increasing development of the West Indian fruit trade; but in reading those glowing statements it may be asked, "Is not too much being said about this progress, and that with an object in view?" If, as I fear, an attempt is being made in some quarters to avoid dealing with the important and urgent question of the sugar bounties by trying to make it appear that the cultivation of fruit can successfully take the place of sugar as the chief industry of the West Indies, the sooner the fallacy of such a belief is seen, the better. Such an opinion is certainly not held by anyone who has carefully and impartially studied the subject. Sugar is, next to wheat and cotton, the most important of the world's crops, and with the exception of wheat and perhaps rice, the chief article of human food, and so its place could never be taken by such a comparatively secondary commodity as fruit. To ask, therefore, the West Indian planters to discard sugar for fruit is as absurd as the advice given by Mr. Gladstone to the British farmers to place their trust in jam. Those who speak so glibly about fruit taking the place of sugar forget the immediate loss which such a change would entail upon the sugar growers who can so ill afford it, even although future success were certain, which is by no means the case.

For over two centuries sugar growing has been the staple industry of the West Indies, and so in the event of its being abandoned all the experience and skill which have been accumulated and handed down during that time would be lost, and in addition the trouble, expense, and delay of learning a new occupation incurred. Then there would be the greater, because more tangible, loss of all the capital, not less certainly than several millions, now sunk in buildings and machinery available only for sugar production. Then, even if the change were effected, what security have the planters that their position would be improved? Spain, Portugal, and other fruit-growing countries might give a bounty on the export of fruit, just as France and Germany now do on sugar, and the last state of the West Indies would then be worse than the present.

The fact therefore remains that, fruit or no fruit, the question of the West Indian sugar industry must be faced, and that immediately. Nor is this a matter, as is sometimes erroneously thought, only for those engaged in the West Indian sugar trade and its dependent industries; on the contrary, it concerns all the commercial world. The apathy, and, as they and many others think, injustice with which we treat the West Indians is causing them, as their trade statistics show, to buy less from us each year as compared with the preceding, and to import more from America and Germany. The matter is, therefore, a vital one for the engineers of Glasgow, London, and elsewhere, the manufacturers of Manchester, and the brewers of Burton, whose products are being superseded by those of the countries I have named. It is, therefore, to the interest of the above-mentioned and many other home manufacturers to aid in the pressure which is being applied to Government to do justice to the West Indies.

What form this should take is a question on which much difference of opinion exists. Without, however, considering all these schemes (some of them, as we have seen in the case of the fruit trade, not very practicable) there is one which, along with other reccommendations, has the merit of not violating Free-trade principles, the great objection to many proposals such as that of countervailing duties, and of not requiring the co-operation of foreign governments, as the abolition of the bounties would. It is the opinion of many of the most competent judges that, with new and improved machinery, and especially with the concentration of the manufacture of sugar from cane in a few large factories instead of as at present in small ones, the

West Indies would supply cheaper and better sugar than any of the Continental countries, even with the bounty.

The establishment of Central Sugar Factories is therefore the most urgent want of the West Indies, and at the same time one which will not interfere with any other form of relief. Their erection, however, requires a considerable expenditure of capital, which the planters cannot afford and which British investors, in the face of the bounties, do not care to advance without a guarantee. At one time, after the recommendation of the West Indian Commission, and especially after the matter had been pressed on his attention by a prominent Glasgow gentleman who has made a life-long study of the question, it was thought that Mr. Chamberlain, who had obtained the sanction of the House of Commons, would have given such a guarantee, and had he done so the problem of the West Indies would have been near a solution. Instead of doing so, however, he adopted two other courses, neither of which has had any practical result. In the first place he appears to have persuaded Sir T. Lipton that if anyone could revive the drooping fortunes of the West Indies, he (Sir Thomas) was the man to do it, and he certainly sent out a representative to report on the situation, but as yet nothing has been done in this quarter. Perhaps he is too busy with the Shamrock. Then on the other hand, Sir C. Quilter and Sir Neville Lubbock kindly relieved Mr. Chamberlain of a part of his responsibility by sending out two gentlemen who had no experience of Central Sugar Factories, on which they were to report, and who, indeed, have not yet made any report, so that here, too, there is nothing but delay. If the intention had been to shelve the question, Mr. Chamberlain could not have succeeded better, and now that his hands are full with the Transvaal the case of the West Indies appears more hopeless than ever, unless public opinion will demand the application of the only immediate and practicable remedy—the guaranteeing by the Imperial Government of the funds for the erection of Central Sugar Factories.

Your obedient servant,

A Student of the Question.

The quantity of sugar to be sold in the home market during the season 1899-1900 has been fixed provisionally by the Russian Minister of Finance at 35,000,000 poods. Equal to 573,300 metric tons. The total reserve stock to be held by the manufacturers and refiners is fixed at one-tenth of the above quantity.

NOTICES OF BOOKS.

LISTE GENERALE DES FABRIQUES DE SUCRE, RAFFINERIES ET DISTILLERIES de France. d'Allemagne, d'Autriche-Hongrie, de Russie, de Belgique, de Hollande, d'Angleterre, et de diverses Colonies, suivie de Notes sur le Contrôle Chimique dans les Fabriques de Sucre, de Statistiques sur la production du Sucre et de la Législation des Sucres et des Usages commerciaux en France et dans les principaux pays. Campagne 1899-1900. Paris, 160, Boulevard de Magenta, aux Bureaux du *Journal des Fabricants de Sucre.*

We have received the new issue of the above, and have pleasure in once more recommending it to our readers. The price is extremely low, viz., 2 fr. 60 c., post free, and all interested in the sugar question should possess the book, which contains the full text of the French law of 7th April, 1897, regulating the bounties on exported sugar.

ZABEL'S JAHR- UND ADRESSENBUCH DER ZUCKERFABRIKEN EUROPA'S für die Campagne 1899-1900. Published by the "Centralblatt für die Zuckerindustrie." 30th year of issue. To be had from the "Verlagsanstalt für Zuckerindustrie," Magdeburg, Germany. Price 4 Mark.

The object of this most useful manual is to be "an indispensable handbook for every sugar manufacturer." It is, on the whole, the best book of the kind published, and we always consult it by preference; the accuracy and fulness of its details leave nothing to be desired, and it has the great recommendation of being so clearly drawn up and printed as to be used without difficulty by those who, like too many of our countrymen, have only a superficial knowledge of the German language. To the present edition is prefixed a short but interesting notice of the late Dr. Carl Scheibler, whose services to the German sugar industry can scarcely be overrated, accompanied by a striking portrait.

INTERNATIONALE ZUCKERPRAEMIEN-POLITIK. Von Mosco-Wiener, Budapest. Reprinted from the *Zeitschrift fuer Volkswirthschaft.* Vienna, Wilh. Braumüller.

We have received the above reprint, of some 23 pages, and must confess that we are unable to regard the proposals and conclusions of

the writer as offering any feasible solution of the question of sugar bounties, which have so long operated to the disadvantage, not only of the sugar industry of the world, but to that of the bounty giving countries themselves, by closing the way to the sound and natural development, indeed to any development at all, of the consumption of sugar within their own borders. We do not, to begin with, share his opinion that the prospect of an abolition of bounties by international agreement is hopeless, because of the divided individual interests of the countries concerned. The difficulties are admittedly great, but they are not insurmountable, as will, we firmly believe, be seen when the fiscal authorities of two or three more countries become as fully aware of facts as we feel certain the German Imperial Treasury officials already are. And the very slow progress made by the respective International Congresses is a proof of the difficulties. But the latter are really insignificant in face of those which would stand in the way of the carrying out of such a scheme as Mr. Mosco-Wiener proposes, which we understand to be nothing less than an international arrangement by which every sugar producing country should have the amount of its premiums assessed and regulated according to its capacity, &c., and further the markets indicated in which its produce should be sold. The restrictions necessary to effect this, in which the writer sees no difficulties "of any material but only of a formal nature" would, to our mind, upset nearly every economical law by which industry and commerce have been or can hope to be guided and benefited.

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; 322, High Holborn, London; and 118, New Street, Birmingham.

ENGLISH.

APPLICATIONS.

15815. Heinrich Fischer, London. *A process of and apparatus for obtaining ammonia and its salts from the spent liquor of molasses in sugar factories and from vinasse.* 2nd August, 1899.

16578. L. HAAS and A. GRANTZDORFFER, London. *Improvements relating to the crystallisation of sugar obtained from the by-products of sugar factories, and to apparatus therefor.* 15th August, 1899.

17124. F. R. GRIFFITHS, London. *A new or improved spoon or sifter for use with sugar and the like substances.* 23rd August, 1899.

17720. E. DE MEULEMEESTER, London. *A rapid and complete process for extracting saccharification worts in brewing.* 1st September, 1899.

17734. J. TURNER, Glasgow. (A communication by W. M. Miller, Straits Settlements.) *Improvements in and relating to evaporating appliances.* 2nd September, 1899.

17821. A. READ, London. *Improvements in the method of and means for the manufacture of stick bars or rolls of boiled sugar, particularly of the kind having lettered or figured designs.* 4th September, 1899.

17925. L. DEPROIT, London. *An improved product designed for use as a substitute for glucose or gum used for industrial and alimentary purposes.* 5th September, 1899.

17926. L. DEPROIT, London. *Alimentary product for use as a substitute for honey.* 5th September, 1899.

17927. L. DEPROIT, London. *An improved alimentary product, obtained by the mixture of saccharine or saccharine compounds and sugar.* 5th September, 1899.

17968. D. B. MORISON, London. *Improvements in and apparatus for evaporating liquids.* 5th September, 1899.

ABRIDGMENTS.

25642. O. IMRAY, London. (A communication by Ranson's Sugar Process, Limited, Paris.) *Improvements in purifying and decolorizing saccharine liquors.* 5th December, 1898. The inventors claim for purifying and decolorizing saccharine liquors, a process utilising the chemical bleaching power of hydrosulphurous acid and the chemical and mechanical action of insoluble tin compounds by the combined use of nascent hydrosulphurous acid and insoluble tin compounds produced in the body of the liquid resulting from addition of sulphurous acid and tin paste.

UNITED STATES.

ABRIDGMENT.

626759 O. T. JOSLIN, New York. *Evaporating device.* 13th June, 1899. This application pertains to a novel device for thickening

liquids by changing the temperature of the liquid by subjecting it to the action of a thermal agent to extract the contained moisture, and further to a novel apparatus for carrying out such method.

628985. GEORGE KASSNER, Münster, Germany. *Process of making lead sucrate.* July, 18th, 1899. The process forming the subject of this invention involves the employment of oxide of lead as a separating agent, and is based upon the fact (which is well known to scientists) that it yields combinations of sugar and lead which are only soluble with difficulty. This, as stated, was merely a scientific discovery, as was also the circumstance which was first pointed out by Dubrunfaut, the sucrate of lead forms at ordinary temperature, and that it does so gradually, when litharge is allowed to stand at rest with a pure solution of sugar. These scientific data, taken by themselves, were of no practical value and totally unfit to render any service to the trade, lacking, as they did, various features essential to success; and, in truth, it has hitherto occurred to no one to attempt to render Dubrunfaut's discovery serviceable for the trade or market, for extracting sugar from molasses or from any mixture embodying foreign or impure substances, much less for separating the several kinds of sugar from each other; all this having been impracticable for want of experience and because the behaviour of lead in the different cases alluded to was unknown. The inventor, therefore, has assumed the task of ascertaining the requirements to be fulfilled, which, not having been known before, might not be complied with. He has, after numerous trials partly unsuccessful, at length succeeded in devising a really serviceable process, and, what is better still, in imparting to it the character of a continuous circular process (or what is sometimes called a "cycle"), wherein all the materials or agents employed are brought back to their starting points after having performed their respective duties. The most important conditions upon which the successful performance of the process depends are as follows:—(*a.*) The oxide of lead employed should be in the form of a powder, which must be as fine and as uniform as possible. (*b.*) Between the oxide of lead and the sugar there should be a predetermined relation of weight, especially when the process is carried on on rational lines—that is to say, for manufacturing or commercial purposes. (*c.*) The concentration of the solution should be so proportioned that the resulting combination of oxide of lead with the sugar can be but slowly precipitated at the bottom of the vessel. (*d.*) Care should be taken to insure as close and as uniform a contact

as possible between the heavy insoluble oxide of lead and the solution of sugar. This may be done, for example, by keeping the mixture in violent motion or briskly stirring it until sucrate begins to form. (*e.*) The separating of the sucrates should be so conducted that the various sorts of sugar may be collected separately.

630174. D. T. BRAND, Eastman, Georgia. *Evaporating apparatus.* 1st August, 1899. This invention relates to that class of evaporating apparatus in which evaporation of a continuous shallow stream of flowing juice and syrup is carried on. The object of the invention is to provide an apparatus in or through which a stream of juice introduced at one end of the pan will be given a substantially uniform heat throughout its course from the receiving to the discharge end of the pan, thereby insuring a constant and uniform rate of passage from one end to the other, avoiding cool spots or zones, which have the effect of rendering the stream sluggish at such spots and of allowing the scum or other impurities to mix and become incorporated with the syrup, thereby injuring the colour and flavour of the final product. In other words, the object of this invention is to produce an absolutely automatic skimmer or separator of impurities from the juice as the same is evaporated to produce a syrup.

630365. U. LAPLACE, New Orleans. *Filter attachment for centrifugal machines.* August 8th, 1899. This invention relates to centrifugal machines and the application thereto of the principle of filtration of fluids by centrifugal force. It consists of a filter attachment to a centrifugal machine, the said attachment being adapted to be placed in and removed from the rotary basket of an ordinary centrifugal machine, and having for its purpose to remove all or almost all solid matter from fluids.

630736. T. L. PATTERSON, Greenock. *Centrifugal machine.* August 8th, 1899. This invention comprises certain improvements in centrifugal machines for use in sugar factories and refineries, and in various processes in the chemical arts which make it possible to separate and classify the drainage into two or more portions according to its purify, as for instance, in the sugar industry the impure molasses or syrups can be separated from the comparatively pure washings or steamings. When the latter are returned to the pan and boiled into the same quality of masse-cuite as that from which they were separated, the highest yield of sugar will be obtained at the expense of the next lowest quality.

631072. J. GROSSE, Kiew, Russia. *Process of sugar boiling.* August 15th, 1899. In crystallising impure solution and especially the after-products in the manufacture of beet-sugar, it requires even by the most approved and complete processes from four to fourteen days according to the quality of the liquor to be crystallised. The object of this invention is to accelerate the crystallisation of impure or difficultly-crystallising liquors, and this acceleration or shortening of time is intended to be produced by subjecting the liquor to be crystallised in the lower strata of its mass to the action of heat in a vacuum or partial vacuum while simultaneously agitating the liquor from the lower layers toward the upper layers, so that the individual particles of the liquor are subjected to continuous evaporation and frequent changes of temperature.

631603. M. ZAHN, Artern, Germany. *Process of refining sugar.* August 22nd, 1899. This invention relates to sugar-refining, and consists in a process in which superheated steam is forced through the sugar at such a temperature that no further heating will be required for drying, and then as the cleansing and refining of the sugar is nearing completion there is forced into and through the mass of sugar-crystals a mixture of colouring matter and syrup. In the process of refining sugar there can be distinguished four different phases in the conversion of the raw product present in form of masse-cuite into the dry, refined and marketable product (granulated), viz.: First, separating crystals and syrup; second, cleansing and washing the crystals; third, bluing the crystals; fourth, drying the crystals. These four operations heretofore have either been performed in separately located devices or else different means or mediums have been employed to accomplish the several operations of the refining process. One object of the invention is to perform the said four operations in a single apparatus (centrifugal), using but one medium, superheated steam, in the successive operations of cleansing and bluing.

631568. W. B. GERE and J. S. MERRELL, Syracuse, U.S.A. *Evaporator.* August 22nd, 1899. This invention relates to that class of drying-machines which are used for drying liquid and semi-liquid materials and which embody one or two hollow steam-heated cylinders, which are arranged horizontally and are slowly rotated, and which received the liquid material to be dried on the lower portion of their outer surface and elevate the material in a thin layer or

coating and carry the same over to the opposite side of the cylinder, where the material which has become dry during its movement with the cylinder is removed by a scraper. Its object is to produce a drier of this general character which is suitable for drying liquid or semi-liquid materials which are not sufficiently adhesive to permit of their being picked up by the cylinder and elevated for the purpose of distributing the materials in a thin layer over the surface of the drying-cylinder.

631958. M. S. DUNHAM, Toledo, Canada. *Evaporating pan.* August 29th, 1899. This invention relates to sap-evaporators, and has for its general object to provide an evaporator, which, while of a very simple and inexpensive construction, is calculated to effect rapid evaporation of maple-sap and other juice, and automatically perform all the functions necessary to the reduction of the sap or juice to syrup. Another object of the invention is to provide an evaporator embracing a sap-pan, a syrup-pan, and a syphon connection for conducting partially evaporated sap from the former to the latter, the syrup-pan preferably being reversible in order to avoid the accumulation in the said pan of calcium malate inherent in the sap.

632616. D. ALFVEN, Stockholm. *Centrifugal machine.* September 5th, 1899. This invention has for its object structural features, whereby the efficiency of the separator is materially enhanced, and the operation of separation greatly facilitated and expedited.

632617. D. ALFVEN, Stockholm. *Centrifugal machine.* September 5th, 1899. The object of this invention lies in the provision of means, whereby the solid constituents separated from a liquid are divided and guided or conducted to separate discharge passages or ports.

103164. W. F. DRAHY, Teplitz. *An improved cleanser, applicable for rock cutting or sugar candy machines.* 12th March, 1898. A projection is attached to a shaft. When the shaft revolves, this projection presses on another projection attached to a frame. The frame is mounted so as to revolve on a pin, so that by the pressure exercised by first-named projection upon the projection attached to the frame, the frame revolving on the pin, is rotated in a downwards direction. When the projection attached to the shaft is released from engagement with the projection attached to the frame, by the action of a spring attached to the frame, the frame is again moved upwards. A receiver is provided on the frame for the purpose of receiving the rock

sticks to be cut. A cylinder provided with a brush revolves on a pin. The end of the frame engages in a recess of this cylinder. If now the frame move in the upward direction mentioned above, the cylinder with the brush is set in action by means of the frame, so that the brush, on the frame reaching its lowest position, extends over the receiver attached to the frame and cleanses the same. The brush then again resumes its original position.

103592. FRANZ MALINSKI, Rener, near Prebyslaw. *Process applicable for the production of glucose from starch by the aid of fluoric acid.* 16th December, 1897. To 100 kg. starch, stirred with a uitable quantity of water, is added ½ kg. of 50 per cent. or 1 kg. of 20 per cent. dilute hydrofluoric acid for the saccharification, the acid being diluted with 10 litres water and then the ½ of the acid mixture is stirred into the starch and the other half poured into the converter vessel, and as soon as this is brought to the boil the starch mixture is gradually added, the boiling going on uninterruptedly, and is finally converted into sugar under 1 atmosphere pressure. Then the fluoric acid is again entirely removed as fluoride of calcium by being neutralised with carbonate of lime, said fluoride of calcium being absolutely insoluble in the sugar solution. The sugar syrup produced by this method contains at the most only 10% of the residual matter, which is usually found in glucose. In this residue not a trace of fluoride of calcium can be found by spectrum analysis, and the sweet taste of the sugar syrup is unusually pure. The fluoride of calcium filtered off through filter presses is again used for the production of fluoric acid.

Patentees of Inventions connected with the production, manufacture, and refining of sugar will find *The International Sugar Journal* the best medium for their advertisements.

The International Sugar Journal has a wide circulation among planters and manufacturers in all sugar-producing countries, as well as among refiners, merchants, commission agents, and brokers, interested in the trade, at home and abroad.

IMPORTS AND EXPORTS OF SUGAR (UNITED KINGDOM).

To end of August, 1898 and 1899.

IMPORTS.

Raw Sugars.	Quantities.		Values.	
	1898.	1899.	1898.	1899.
	Cwts.	Cwts.	£	£
Germany	3,796,677	3,336,025	1,701,600	1,686,602
Holland	192,693	297,625	79,574	138,696
Belgium	705,315	979,148	310,286	484,911
France	1,870,307	968,402	938,819	548,584
Java	94,585	104,332	52,351	61,152
Philippine Islands	772,480	161,149	341,859	73,872
Cuba and Porto Rico	14,380	1,320	8,108	1,000
Peru	752,205	257,801	376,358	145,030
Brazil	424,377	55,365	201,497	28,752
Mauritius	11,560	105,400	5,614	51,058
British East Indies	281,590	527,723	119,748	267,036
British W. Indies, British Guiana, & Brit. Honduras	736,411	707,003	444,204	523,741
Other Countries	532,302	819,024	256,240	459,651
Total Raw Sugars	10,184,882	8,320,317	4,836,258	4,470,085
Refined Sugars.				
Germany	7,609,265	8,112,661	4,624,166	5,056,176
Holland	1,503,800	1,444,390	968,022	954,932
Belgium	256,278	244,294	163,000	157,891
France	1,862,238	1,445,971	1,133,809	918,626
United States	7,073	5,938	7,661	6,686
Other Countries	36,278	30,616	21,463	19,831
Total Refined Sugars	11,274,932	11,283,870	6,918,121	7,114,142
Molasses	743,022	970,969	191,783	238,201
Total Imports	22,202,836	20,575,156	11,946,162	11,822,428

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden and Norway	66,286	47,387	39,015	29,966
Denmark	86,874	110,457	44,330	63,654
Holland	73,313	70,267	41,166	43,747
Belgium	10,711	9,298	6,045	5,847
Portugal, Azores, &c.	50,738	49,233	27,407	28,576
Italy	26,325	12,926	13,958	7,564
Other Countries	138,333	128,052	80,610	78,507
	452,580	427,620	252,531	257,861
Foreign & Colonial Sugars.				
Refined and Candy	128,525	104,948	78,996	68,263
Unrefined	298,079	187,248	163,094	113,613
Molasses	192,237	64,200	58,808	21,429
Total Exports	1,071,421	784,016	553,429	461,166

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1899. Tons.		1898. Tons.
Total Receipts, 1st Jan. to 14th Sept. ..	1,269,057	..	958,569
Receipts of Refined ,, ,, ,, ..	1,711	..	21,548
Deliveries ,, ,, ,, ..	1,269,823	..	1,014,634
Consumption (4 Ports, Exports deducted) since 1st January	1,200,602	..	990,018
Importers' Stocks (4 Ports) Sep. 13th ..	4,557	..	13,651
Total Stocks, September 20th	189,000	..	193,738
Stocks in Cuban Ports, September 20th ..	22,000	..	47,595
	1898.		1897.
Total Consumption for twelve months ..	2,047,344	..	2,071,413

CUBA.

Statement of Exports and Stocks of Sugar, 1898 and 1899.

(Tons of 2,240lbs.)	1898. Tons.		1899. Tons.
Exports	198,380	..	275,534
Stocks	67,529	..	28,657
	265,909		304,191
Local Consumption (eight months)	32,600	..	25,750
	298,509		329,941
Stocks on the 1st January (old crop)	1,515	..	4,336
Receipts at Ports up to 31st Aug... ..	296,944	..	325,605

Joaquin Guma.

UNITED KINGDOM.

Statement of Eight Months' Imports, Exports, and Consumption for Three Years.

	1899. Tons.		1898. Tons.		1897. Tons.
Stock, 1st January	76,930	..	90,030	..	139,623
Imports, Raw Sugar, Jan. 1st to Aug. 31st	416,016	..	509,244	..	417,485
,, Refined, Jan. 1st to Aug. 31st ..	564,193	..	563,747	..	510,990
,, Molasses, Jan. 1st to Aug. 31st ..	48,548	..	37,151	..	40,214
	1,105,687		1,200,172		1,108,312
Stock, in 4 chief Ports, August 31st.. ..	44,000	..	100,000	..	72,000
	1,061,687		1,100,172		1,036,312
Exports (Foreign, and British Refined) ..	39,201	..	53,571	..	62,506
Apparent Consumption for Eight months.	1,022,486		1,046,601		973,806

STOCKS OF SUGAR IN EUROPE AT UNEVEN DATES, SEPTEMBER 1ST TO 20TH, COMPARED WITH PREVIOUS YEARS.

IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	TOTAL 1899.
43	167	258	93	32	593

	1898.		1897.		1896.		1895.
Totals	692	..	665	..	850	..	912

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING AUGUST 31ST, IN THOUSANDS OF TONS.

Great Britain.	Germany	France.	Austria.	Holland, Belgium, &c.	Total 1898-99.	Total 1897-98.	Total 1896-97.
1620	766	579	388	449	3802	3764	3528

ESTIMATED CROP OF BEETROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE CURRENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1898-99. Tons.	1897-98. Tons.	1896-97. Tons.	1895-96. Tons.
Germany	1,721,718 ..	1,852,857 ..	1,836,536 ..	1,615,111
Austria	1,051,290 ..	831,667 ..	934,007 ..	791,405
France	830,000 ..	821,235 ..	752,081 ..	667,853
Russia	795,000 ..	738,715 ..	714,936 ..	712,096
Belgium........	220,000 ..	265,397 ..	288,009 ..	235,795
Holland........	149,763 ..	125,658 ..	174,206 ..	106,829
Other Countries..	160,000 ..	196,245 ..	202,990 ..	156,340
	4,927,771	4,831,774	4,902,765	4,285,429

It will be seen that the definite figures for Germany, Austria, and Holland are in all cases slightly below, though very near, the approximate estimates given last month.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

Very early in the month now closing it began to be evident that the Continental speculators would not be able to continue holding their large stocks, and, in face of a very promising statistical position, they were compelled to realise, the result being a fall in prices of beet. This naturally caused a dullness in the market, but the small quantity of old sugar combined with fair demand, and the small amount of disturbance caused by the realisation of the speculative holdings, soon imparted renewed firmness. In the second week, favourable weather, together with a readiness to accept lower prices for French crystals, had a depressing effect on beet prices, which was intensified by an increase in the visible supplies, and the feeling thus evoked has continued more or less up to the time of writing. Refiners have had to reduce their quotations, in face of small demand and the falling market.

It seems quite certain that the United States will for some time be independent of the European market, and as the current estimates of the coming beet crop, which of course are at present merely probable guesses, seem to point to higher figures than those of the past season, there is just now nothing to produce any animation. Transactions in cane sugars, where there are any offering, are limited and at low prices, excepting in West Indian sorts for consumption, which, being scarce, fetch full previous rates.

The following quotations are in all cases for prompt delivery :—

			Last Month.
Porto Rico, fair to good Refining	10/6 to 11/0	against	11/0 to 11/6
Cuba Centrifugals, 97°/o polarization....	11/6 to 11/9	,,	12/0 to 12/6
Java, No. 14 to 15 D.S.	12/0 to 12/3	,,	12/6 to 12/9
British West India, fair brown	10/6	,,	10/9 to 11/0
Bahia, low to middling brown	10/0	,,	10/0
,, Nos. 8 and 9..	10/3	,,	10/6 to 10/9
Pernams, regular to superior Americanos.	10/3	,,	10/3 to 10/9
Madras Cane Jaggery	9/9 to 10/0	,,	10/0
Manila Taals	9/3	,,	9/6 to 9/9
French Crystals, No. 3, f.o.b.	10/7½	,,	11/0
Russian Crystals, c.i.f..	?	,,	?
German granulated, f.o.b.	11/6	,,	12/1½
Tate's Cubes..	15/9	,,	16/0
Beet, German and Austrian, 88%, f.o.b...	9/6	,,	10/1

THE INTERNATIONAL SUGAR JOURNAL.

No. 11. NOVEMBER 1, 1899. Vol. I.

☞ All communications to be addressed to Edward Sutton, Office of *The Sugar Cane*, Manchester.

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☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

It is satisfactory to hear that the scheme which has for some time been on foot for an extension in British Guiana of the valuable experiments with cane growing—which have in the past given such an impulse to the efforts to obtain richer and more permanent canes—has now assumed a definite shape. The extracts from Demerara newspapers given in the present number will supply all the requisite information, and while we notice that the *Daily Chronicle* views with satisfaction the possibility of a saccharine content of 16 per cent., we would specially call attention to the important fact announced in Professor Carmody's analytical report on cane grown in Trinidad, that no less than five varieties of seedlings raised in the Botanic Gardens at Trinidad under the superintendence of Mr. Hart, have shown a saccharine content of over *20 per cent.* These seedlings and the experiments of which they are the result are to a large extent the outcome of the initiatory work of Messrs. Bovell and Harrison in Barbados, and of Messrs. Jenman and Harrison in Demerara, and the only question now to be decided is how far these seedling varieties can be considered as permanent. It has long been recognised that time and continued experiment were required before we could assume with any certainty that the improvement, which scientific skill and assiduity had effected in the case of the European beet, could be equally secured in the case of the tropical cane, but we may now—in face of the facts announced from Trinidad, and the reasonable security we have for the continuation of the necessary experiments there and in other

West India Islands and in British Guiana—feel tolerably certain that the day is not far distant when the present yields will be so far exceeded that the planter will wonder how ever he managed to live at all with such defective raw material to work upon.

It will be seen by the Trinidad report on the analysis of seedling canes, summarised further on, that valuable assistance has already been rendered by two estates in that island in supplementing the work of the Botanic Gardens by experimenting with some of these seedlings. It is sincerely to be hoped that many more planters in that island and elsewhere will lend a hand in this most useful supplementary work, and so materially hasten the time when at least one or two of these most promising rich varieties will be available for practical cultivation on a large scale.

Blyth Brothers & Co. report shipments of sugar from 1st August to 27th September, 1899, as 10,874 tons. Business was somewhat dull, owing to poor demand from India and Australia.

Exports from British Guiana from 1st January to 10th October:—Sugar, 42,295 tons; rum, 939,453 gallons; molasses, 4,120 casks; cocoa, 124,778 lbs.; against 63,995 tons; 1,458,400 gallons; 2,319 casks; and 48,999 lbs. respectively for the like period last year.

The countervailing duty on German sugar imported into India has been reduced from 15 annas 3 pies to 14 annas 7 pies per cwt.

From Java a correspondent writes:—"I noticed the paper from Pernambuco in your July issue, but if the writer thinks he is the only one who is raising cane from seed on a large scale, he is mistaken as far as concerns Java. The Kremboeng estate is entirely planted with canes from tops the parents of which have originally been raised from seed, and Mr. Moquette, the enterprising planter, is very well satisfied with the results he is obtaining. He raised several thousand plants from seed, propagated them by cuttings, and studied the new varieties. He kept only those likely to give a good crop, and selected from these such as had a high saccharine content and showed themselves able to resist disease, &c. He has got varieties which ripen early and others which mature late, canes which do best on a heavy soil and others which prefer a lighter soil, and so he is able to plant every part of his estate with canes which best suit the locality, and

the difference in time of ripening allows him to grind the respective canes under the most favourable conditions."

It is with deep regret that we receive the announcement of the closing of the large sugar refinery of Crosfield, Barrow & Co., Liverpool. A long extract from a Liverpool paper, which will be found elsewhere, gives full particulars. It is to be feared that Mr. Crosfield's anticipation that the British refining industry is on the eve of extinction will in no long time be fatally verified. It is not possible for our refiners to stand the unrighteous competition of the bounty fed sugar, and it is ridiculous to expect that men of sense and capital will continue to work for no profit and even at an actual loss.

The *American Grocer* issued, on 15th September last, a special illustrated number in commemoration of the 30th anniversary of its establishment. Seeing that the *Sugar Cane* first saw the light in the same year, about a month before our esteemed contemporary, we naturally feel very sympathetic on the occasion. We congratulate the *American Grocer* on the great success which has attended its steadfast endeavours during so long a period, a success which we feel thankful to share, and we heartily wish for it and ourselves a continuation of that prosperity and progressive advancement which we believe both have honestly striven to deserve.

A BLOW TO BRITISH INDUSTRY.

CLOSING OF LIVERPOOL WORKS.

The Result of Foreign Bounties.

From the Liverpool *Journal of Commerce*, October 17th.

Yesterday, a representative of this journal called on Messrs. Crosfield, Barrow, & Co., sugar refiners, 323, Vauxhall Road, and obtained from Mr. Charles James Crosfield a confirmation of the report—unfortunately for Liverpool, only too true—that the firm have decided to close their works, and that by the end of the year their well-known and extensive refinery will be entirely laid in. The bulk of the men were given a week's notice last Thursday, the rest will be gradually discharged as the affairs of the firm are wound up, and "*finis*" is written to the history of one of the oldest industries in Liverpool.

"Yes," said Mr. Crosfield to our representative, "we have decided to close them. The bounty business will ultimately close all the sugar refineries in the country—there are very few of them left now. We have seen it coming in our case for a long time, but we have always been hoping, rather against hope, that something would be done. The conference at Brussels last year looked as if it was going to produce some result. Nothing came of it, however, because our Government would not do what they ought to have done—agreed to a penal clause which would either have countervailed bounty-fed sugar or prohibited its importation altogether. The British commissioners to the congress advised the Government that some such step was absolutely necessary, but although, since the conference adjourned, the Government have done what we asked them to do with regard to India, they do not see their way to grant the same treatment to us. There is, no doubt, a countervailing duty on bounty-fed sugar in India, and if the same measure had been applied to England it would, in my opinion, have saved us and other people who will ultimately have to follow our example and close their works."

In the course of further conversation our representative was informed that Messrs. Crosfield & Barrow's works have been in existence for nearly 50 years, and give employment to 450 men, the notice to whom, in the majority of cases, will take effect next Thursday. The annual output of the firm has been about 50,000 tons of refined cane sugar; the wages bill alone amounted to £25,000 per annum; but the step the firm have taken will mean losses in other directions, as, for instance, an engineers' bill of from £4,000 to £5,000 for renewals and repairs, £6,000 a year in carting and carrying, over £12,000 for coals, and £1,200 per annum on fire insurance, the bulk of which, falling on Liverpool, is a serious blow to a city that has so few industries of its own, while the stoppage of such an extensive refinery as that of Messrs. Crosfield & Barrow is a significant sign of the desperate state to which the sugar refining industry of the country generally has been reduced, so Mr. Crosfield contends, by the bounty-fed competition of foreign countries,

"We ought to have closed many months ago," Mr. Crosfield said, "but considered it right to fight to the end. So many of our employees are old servants of the firm that we part from them with great regret, and we would not have closed had there been the slightest chance of better times ahead. But, even if better times should come again, it

will be exceedingly difficult to build up once more a connection that has taken half a century to bring together."

As illustrating the effect of foreign bounties on British sugar refining, Mr. Crosfield showed our representative a diagram of the consumption respectively of British refined and grocery cane sugar, and of foreign refined, in 1884 and 1897. In 1884, it appeared, the consumption of British was 842,778 tons; in 1897 it was only 652,000 tons; while the consumption of foreign refined sugar in 1884 was 213,334 tons, and in 1897 it had risen to 792,000 tons. Again, in 1884, our imports of cane from British colonies amounted to 241,221 tons, and in 1897 to only 83,823 tons; foreign cane imports, it is true, had gone down in the meantime from 340,602 tons to 167,769 tons, but raw beet from abroad had risen from 400,794 tons to 462,015 tons; and foreign, or Continental refined, from 213,334 tons in 1884, to 791,604 tons in 1897. The figures for 1898 were practically the same as for 1897; the total cane which in 1897 stood at 17·1 per cent., had gone down to 16·66 last year, while beet at the same time had risen from 82·9 per cent. in 1897, to 83·34 per cent. last year; and figures for the corresponding nine months of 1898 and 1899 showed the same process to be still going on, viz., increased importations of foreign refined beet sugar, a decreased ratio in the production of refined cane sugar at home, and all due, Mr. Crosfield contended, to the operations of the foreign bounty system, against which our Government would take no action beyond expressing sympathy for those concerned.

In answer to further inquiries, Mr. Crosfield said the bounty on raw sugar exported from foreign countries to England varied from 25s. per ton in Germany to as much as £4 10s. per ton in France; the bounty on refined was 10s. more in the case of Germany, which was our chief competitor, while France did not export so much refined sugar; at any rate, the refined she did export did not compete so much with England as German refined sugar. "It is evident," said Mr. Crosfield, "that what has destroyed our trade is the bounty, the difference in the bounty on refined and raw sugar, because the bounty on raw sugar, although it has destroyed the trade of the West Indies, does not really have any effect on us here as sugar refiners. Now, the extra bounty of 10s. per ton on refined over raw sugar, though it is a matter that is destroying the British sugar refining industry altogether, is a thing that the consumer would never feel at all, because 10s. per ton is only sixpence per cwt., or one-sixteenth of a penny per lb. of sugar."

"Then do you ask the British Government to grant you a bounty on your sugar?" our representative asked.

"No, we do not ask for any bounty at all, for any protection at all, in the technical sense of Protection. What we do want is the protection of the British sugar refiner against his foreign competitor, which is enjoyed by every peaceable citizen against the depredations of others; we want 'police protection,' so to speak, and nothing more. If, for fiscal reasons, the prohibition of the importation of the sugar from any country which did not agree to abolish bounties should be considered more convenient, it would have exactly the same effect. We want the abolition of bounties. Whether it is done by one method or another is a matter that does not concern us."

"But suppose other countries are not willing to abolish bounties?"

"They are all willing to do so except France and Russia, Germany, Austria, Belgium, and Holland are all willing, but the British Government, though they have expressed their desire and willingness to abolish bounties, have always stopped short of the necessary step, namely, the prohibition of imports of sugar from these countries—France and Russia—which did not agree, or the imposition of a countervailing duty on sugar imported by them into England."

Questioned as to whether such a step would not raise the price to the home consumer, Mr. Crosfield said: "I do not think the public would have to pay more for their sugar. Even if they did, it would be so little they would never feel it, and the proof is that we have at present fluctuations in the sugar market to a much greater extent during the year, and they cause no decrease in consumption."

In conclusion, Mr. Crosfield said that Liverpool, up to the present, had been the largest area of sugar refining in the country, but the disappearance of his firm would leave only three others in existence, and the Clyde sugar refining industry was in an even worse state. He took a gloomy view as to the future of the industry, unless the British Government resolved on action along the lines above, and intimated that his views of the causes of depression were shared by other firms in Liverpool, and were, indeed, general among the sugar refiners of the country as being the explanation of the decline of the industry, and containing the only remedy for the present disastrous state of affairs.

THE FUTURE OF THE SUGAR INDUSTRY.

For some time, *i.e.*, ever since the acquisition—in one form or another—by the United States of the Hawaiian Islands, Porto Rico, Cuba, and the Philippines, the minds of many thoughtful and observant men have been more or less exercised as to the future course of the great sugar industry of the world, even though they might not be directly interested therein. And this is not to be wondered at, because such men are not strangers to the fact that the beet sugar industry and its continuance rest largely on an artificial basis, while the cane sugar industry, the production of which is about to be so largely increased, is to a great extent, with the exception of that of Louisiana, still left to natural resources. Naturally then the French and German specialist journals have been occupying themselves with predictions and speculations respecting the ultimate effect of the passing of the above-mentioned cane growing countries into the hands of the most energetic and persevering of the great commercial nations of the world. And the same questions have not unfrequently been brought up, though we believe not fully discussed, in the regular meetings of the various organisations representing the great body of those interested in Continental beet sugar production. The despatch of Dr. Paasche by the German Finance Minister on a mission of investigation into the possibility and probability of proximate large increase of sugar production on American territory is, however, a sufficient indication of the interest taken in these matters by the German government, which, but for the agrarian party, would long ago have abolished the premiums. See also an article from the *Centralblatt für Zuckerindustrie*, translation of which is given elsewhere in the present number. In view of the magnitude of the interests involved, it is no wonder that the consideration of what to do, and how to do it, is becoming pressing also in France. The subjoined translations will give an idea of what is stirring in France.

On the occasion of the 28th meeting of the "Association Française pour l'Avancement des Sciences" recently held at Boulogne-sur-Mer, the question of the cultivation of beet sugar in the Pas-de-Calais and incidentally that of the French beet sugar industry in general and its position, technical, economical and fiscal, underwent a tolerably full discussion, and the following summary has been supplied to the *Sucrerie Indigène et Colonial* by a correspondent who was present.

M. Ladureau, formerly Manager of the Agricultural Experiment Station Department of the Nord, read three papers, the first on the slow but sure evolution which has been taking place of late years in the manufacture of sugar, in the direction of the manufacturers themselves turning out a large portion of their production in the shape of sugar ready for the consumer. Now that almost all manufacturers deliver from seven to eight-tenths of their productions in the form of magnificent white sugars testing over 99·5, the long and delicate refining operations are no longer required for these fine products, and it is only necessary to bring them into the shape required by the consumer, that of the square lump, to put them into direct sale, and this is effected in the factories by means of various rapid methods of refining, such as that of M. Robin Langlois.

In his second paper, M. Ladureau showed the rapid advance which the production of sugar might assume in Cuba and the United States, thanks to the initiative spirit of the Americans and their boldness as capitalists. He pointed out the danger incurred by our national producers, who were threatened with the closing of the English market, to which we are at present exporting the 380,000 tons of sugar which constitute the excess of our turn out over the home consumption, an economic phenomenon which will be fatal in its results on the day when America and Cuba, producing from five to six million tons, will also be compelled to send their surplus to Europe.

The only remedy for the crisis which would result from the closing of the English market, would be for us to consume ourselves all the sugar we produce, and to secure this result, we must bring down the price of this article to the level at which it is sold in England, viz., 30 to 35 centimes per kilogramme. Now this could only be done by completely abolishing the tax on inland consumption, which, said M. Ladureau, raises the cost to such an exaggerated and fatal extent. The meeting passed the following resolution:—"Inasmuch as the development of agriculture in a large number of the departments of France is intimately connected with the prosperity of the beet cultivation, and, further, as the latter is seriously menaced, in the near future, by the competition of American sugar in foreign markets, and as it is of importance, in order to maintain our production at its present level, to considerably increase the consumption of sugar in France by supplying it at a low price, the French Association for the Advancement of Science expresses the wish that the various taxes on sugar at present existing may be abolished within a short time."

M. Ladureau's third paper related to a reduction in the cost of alcohol, for heating, lighting, and other uses, which might be effected by the use of a cheaper agent for denaturalisation than the one at present employed, and he also suggested that agriculturists would find it much more advantageous to use superphosphates testing 15 to 20 per cent., in place of those now so generally applied, which test only 8 to 12 per cent. of soluble phosphoric acid.

According to the *Journal des Fabricants de Sucre*, the last meeting of the "Société des Agriculteurs du Nord" considered very carefully the question of how to develop the internal consumption of sugar, and the general tendency of transatlantic countries to produce for themselves the sugar necessary for their own consumption, rendering it a constantly more difficult task for the hitherto exporting countries to hold their former markets. This meeting therefore passed resolutions calling upon the French Government to deal with the tax on denaturalised sugar, and to study ways and means for abolishing the tax on internal consumption.

A paper recently read by M. Legras, President of the Agricultural Committee of Laon, contained the following remarks in the same direction:—"The fate of the agriculturist is bound up with that of "the sugar industry. And this is the reason why we join in "demanding the abolition of the tax on sugar, which represents more "than twice the price of the article, and weighs so heavily on its "sale and consumption. Under such conditions, consumption would "increase, the sale augmenting proportionably, and the sugar industry, "freed from every obstacle, desiring nothing but to be left alone to "defend itself without aid or false protection, would be able to offer "a safe prospect to the cultivator of the beetroot." The *Journal des Fabricants du Sucre*, while remarking that there is no mistaking the fact that the idea of the abolition of taxation is making way in the sugar producing departments, warns them against being misled, for the task of removing these taxes is no easy one. Their abolition would mean, in the first instance, the doing away with the indirect (*bonis de fabrication*) and direct premiums, to which the sugar manufacturers are by no means disposed to consent unless their foreign competitors will, on their part, make equivalent sacrifices. And then, by what could the sum produced by the sugar tax be replaced? This figured for no less than 186,494,000 francs (nearly £7,500,000) in the provisional budget of 1899. M. Dureau concludes that for the present the views of the agricultural associations will by force of circumstances

continue to be of a platonic character, but admits that the study of the rational solution of the sugar question must necessarily be pursued without intermission. For our part, we see no possible salvation for the French sugar industry in any other direction than in the increase of the internal consumption, which we also regard as only possible to any effectual extent by the immediate reduction and eventual extinction of the tax upon sugar.

CUBA AND THE EUROPEAN SUGAR INDUSTRY.

From the *Centralblatt fuer die Zuckerindustrie.*

In his *Zeitschrift fuer Sozialwissenschaft* (Journal of Social Science), Professor Julius Wolf has attempted an exposition of the prospects opened up for the future of the sugar industry of Europe since the conquest of Cuba by the United States. According to this, Cuba will, within four years, *i.e.*, by 1903, have again reached the highest point of its production, viz., 1,050,000 tons. Of late years the best sugar production has been, in round numbers, 5,000,000 tons; to this must be added the cane sugar production of 3,000,000 tons, making a total of 8,000,000 tons. Had Cuba been lately producing up to her full capacity, without bringing about any greater restriction of production on the part of other sugar-growing countries than has actually taken place, we should have already attained a world's production of some 8,750,000 in place of about 8,000,000 tons, or an excess of not quite 10 per cent. Any excess of production beyond the normal figure always causes a reduction in price much more than corresponds with the excess. Professor Wolf thinks he is not going too far in saying that under the circumstances indicated we should to-day have had prices perhaps two-tenths lower than they are. The effect produced will be about the same, should Cuba really get back to her former capacity of production in three or four years. Other countries will have increased their production pari passu with the increasing consumption. This is a moderate and not unwarranted assumption. Now, if the normal price of 88 % *rendement* sugar is to-day 10 marks, then, according to what has just been said, there is nothing to prevent its being 8 marks, as soon as Cuba has resumed her normal producing capacity, in which case it will have fallen ½-mark below the hitherto lowest average price of 8½ marks in the season 1896-97. This is an approximate provisional computation, a

conjecture. An active promotion of the Cuban sugar production on the part of North America will then raise the question whether at certain prices the cane sugar production is more capable of extension than that of the beet. North America has during the past few years consumed an average of 2,000,000 tons, of which 350,000 have been home production, 250,000 tons from Hawaii. 75,000 tons from Porto Rico, and 200,000 tons from the Philippines. At present things in connection with the cane sugar production are so, that although technical skill has not by a long way effected what it has done in regard to beet sugar production, the cost of production is lower than with beet sugar, For 1894-95 the cost of producing beet sugar in Germany was, after very careful official calculation, found to be 40 pfennig (4⅘d.) per centner (110¼ lb.) of beets worked up. Hence, if we take the usual proportion—8 centner of beets to 1 centner of sugar—and the price of beets at 85 pf., the centner of sugar costs, on an average, 10 marks to produce. But, according to the opinion of the President of the British Refiners' Association, the cost of production in the British West Indies is not more than 9 marks, and in other cane sugar countries, such as Java and Cuba, it is still lower. It may be assumed that the Colonial sugar industry can continue to exist at a price of 8½ and even 8 marks, that is, at a price which is directly ruinous to the European beet sugar industry. This is, says Dr. Wolf, no pleasant outlook for the future of the European sugar industry. Therefore an increase in the inland consumption becomes a necessity. In this matter, the United States, in fact all the countries peopled by Anglo-Saxons—England, Australia, Canada, the Union—show us a brilliant example. In the Union the consumption per head is at present, roughly speaking, 70 lbs. per head; in Germany it was in 1897-98, 23½ lbs., equivalent to 26 lbs. in raw sugar value.

BRITISH GUIANA.

Experimental Cane Cultivation.

The Government have at last made public the details of the scheme for the extension of experimental cane cultivation in British Guiana. Special interest attaches to the proposal, inasmuch as it is the first tangible evidence we have had of the existence in the West Indies of the Department of Agriculture which was created in August last year by the vote of the Imperial Parliament. In a circular issued twelve months ago by the Colonial Office, announcing the establishment of

the new Department, it was intimated that steps would at once be taken to continue and extend the series of experiments in sugar cane cultivation which had been pursued in the colony at the expense of the local revenues, and that a sum of £500 annually would probably be available for that purpose, the total Imperial grant-in-aid for agriculture being $4,800 for the present year. It has thus taken the local authorities twelve months to devise a workable scheme, which will cost £550 annually instead of £500, the figure stipulated in the Colonial Office despatch. Mr. Chamberlain has, however, seen his way to approve of the expenditure, but on the condition that the colony defray the initial expense of introducing the scheme—a sum of $6,100, it is estimated,—and that the present annual contribution of $2,000 from the local revenues be continued. According to Mr. Chamberlain's speech in the House of Commons, in moving the adoption of the supplementary estimate providing for the maintenance of the West Indian Agricultural Department, the Imperial Treasury will support the Department for a minimum term of ten years, the cost being £17,500 annually. We infer therefore, although the Government Secretary's letter to the Royal Agricultural and Commercial Society throws no light on the matter, that the sum of £550 will be available annually for at least the next decade. That would amount in all to £5,500, and this sum, added to the moneys to be supplied by the Colonial Treasury, brings the total cost of the cane experiments to be conducted in British Guiana during the next ten years up to nearly £11,000. It cannot be denied that this is a princely figure to expend upon such an uncertain matter as experimental research. The only consideration that makes the outlay justifiable is the abundant promise of satisfactory results. The experiments with seedling canes that have been carried on at the Botanic Gardens for some years have at least established the fact that it is possible to increase the saccharine content of the cane in the same manner as the Continental scientists have improved the quality of the beet. If a cane with fixed characteristics is obtained, of the same richness as the nursery variety already produced by Professor Harrison, which gave 16 per cent. of sugar as compared with the present average of 13 per cent., the margin of difference in the yield would be over 25 per cent., or an increase of a quarter of a ton upon every ton of sugar manufactured under present conditions. Such a yield, if it could be secured from canes cultivated in the fields in the ordinary manner, would place the sugar industry in this country

beyond the influence of the bounties, and to our mind ten years should suffice to prove whether this anticipation of experts can be realised. The application of scientific investigation to the cultivation of the cane dates from only recent years, so that there are vast possibilities for improvement along the lines that the scheme prepared by Messrs. Harrison and Jenman suggests. We believe, therefore, that the money the Combined Court will be asked to vote to meet the initial expenses will be wisely and usefully spent. Exception may be taken to some of the details of the proposal, and $6,100 will appear a rather large amount to expend merely on preliminaries, especially as it does not include the sum required for the purchase of the additional land that will be needed; but it is advisable that the experiments should be conducted under the most favourable auspices possible and every opportunity given to secure the best results. The sugar industry will remain the staple of the colony as long as the population is concentrated on the alluvial soils of the coast,—a state of things which will continue for generations to come; and since our prosperity as a country will be thus closely identified with the cane, it is but right that everything should be done to improve the existing methods of cultivation as well as of manufacture. The balance remaining unexpended of the Imperial grant, about $2,160, is to be applied to the fostering of agricultural industries other than sugar, and a scheme providing for its utilisation is reported to be under the consideration of the authorities.—*Demerara Daily Chronicle.*

The following more definite details of the scheme are obtained from the *Demerara Argosy*:—

The scope of the present experiments will be enlarged by the following extensions:—(*a*) The duplication of the present series of manurial experiments. (*b*) The extension of the present system of plot control adopted in the manurial experiments to trials of selected varieties of seedlings. (*c*) The extension of the present experiments with nitrogenous manures. (*d*) The extension of the area at present occupied in raising selected seedlings for supplying cane to the planters for experiments on a large scale. (*e*) The removal of all experiments with seedling cane from the present field to land nearer the Government Botanist's house. (*f*) The growth of small areas of different varieties of canes selected for the purpose of raising seed for propagation. (*g*) Experimental examinations of theories adduced

with regard to the influence of the saccharine strength of canes from which the tops have been taken for planting, upon that of their offspring. An area of about two acres will suffice for the examination of these theories and of others from time to time put forth, upon the correctness of which some persons may have grave doubts, although others may uphold them. (*h*) The establishment of small subsidiary stations in the counties of Berbice and Essequebo where the suitability of new varieties of canes for cultivation in these localities can be investigated.

BRAZIL.

Imports of Sugar into the United Kingdom.

The decrease in the Brazilian sugar imports is rather a remarkable feature, and will be clearly seen from the figures underneath. This decrease is largely to be attributed to the fact that Brazil is not now producing much more sugar than is required for internal consumption. At the same time it is probable that such quantity as can be spared for export is being diverted to the United States, which in 1896 absorbed the whole of the exports from Bahia, and in 1898 took 20,032 tons from Pernambuco, against only 11,284 tons from that port to this country, and in 1897-98 absorbed 26,441 tons of the exports from Maceio, against 6,379 tons sent to Liverpool.

	1897. Tons (2,240 lbs.).	1898. Tons (2,240 lbs.).	1899. Tons (2,240 lbs.).
January	1,646	3,096	123½
February	4,235	2,135	11
March	898	1,366	19½
April	1,949	1,887	1,260
May	1,378	1,908	1,270
June	1,988	4,312	57
July	362	4,560	18
August	—	1,954	9
September	164	34	—
October	93	—	?
November	111	176	?
December	3,425	700	?
	16,249	22,128	

JAMAICA AND TRINIDAD.

Tests of some New Varieties of Sugar Canes in Jamaica. Reports from Trinidad.

By F. Watts, F.I.C., Government Analytical and Agricultural Chemist.

In October, 1896, Mr. R. Craig, of Danks Savoy, procured from Hope Gardens ten varieties of sugar cane; these were planted in nursery beds on somewhat stony land of the estate. On August 28th, 1897, these canes were cut and used for planting the field on which the following experiment was conducted; both tops and lower joints of the canes were used for planting. The trial plots had each an area of one forty-fourth of an acre, and the canes were planted in rows 6 feet apart and 2½ feet apart in the row. The soil, a friable loam, was in good condition; no manure was used. The piece of land employed is in a somewhat shady place, screened by a hill from any rapid circulation of air. At the request of Mr. Craig analyses of the juice were made. In order to effect this, appliances were taken to the property and the analyses were made in the boiling house at Danks. It must be pointed out that the specific gravities of the various samples of juice were taken by means of a Beaumé hydrometer, hence no high degree of accuracy can be claimed for the figures representing total solids and purity. Cane sugar and glucose were determined in the usual manner.

The canes were cut, weighed, and crushed, and the analyses were made on February 1st and 2nd, 1899. A sample of 2nd Ratoon Caledonian Queen canes from the ordinary crop of the estate was examined at the same time for purposes of comparison.

In the following table the canes are arranged in the order of the yield of cane sugar in the juice per acre; the table shows the weight of canes per acre, the gallons of juice, the percentage of juice expressed by the mill, the composition of the juice, the number of pounds of cane sugar (unmanufactured) contained in the juice from an acre, together with the proportion of rotten or "rum" canes.

It will be observed that the saccharine richness of the juice in every case is exceedingly low, while the proportion of glucose is very high; in only two cases, China and No. 78, does the cane sugar rise as high as 1·4 pounds per gallon, while in one instance, Po-a-olo, it is below 1 pound. It is difficult to account for these anomalous figures; at first sight they are suggestive of unripe canes, but it will be seen that the canes were over 17 months old. On the other hand, it does not seem probable that the low saccharine richness and high glucose

is due to over ripeness, for the canes were juicy and in no way dried. The season during which they were growing was pronounced a good one. Probably the situation, with insufficient sun and air, may be held to account largely for the poor quality of the juice. It is thought probable that if grown in a more sunny position these canes would give much richer juice, as they have done in other countries. It is to be regretted that there was not a plot of Caledonian Queen cane, the character of which is locally well known, planted in this same field.

Of these canes, six are referred to in the analyses made by Mr. Bowrey and published in this *Bulletin*, October, 1897, pp. 227-231. These are 81, 78, 95, 115, Po-a-ole, and 74. In the case of three of the varieties the quantity of cane sugar per gallon of juice agrees very closely with the figures now given, these are 81, 78, and Po-a-ole, in the last case the comparison being made with Po-a-ole and 2nd Ratoons in Mr. Bowrey's table. In the other three cases Mr. Bowrey's analyses show larger amounts of cane sugar, which would give support to the view that those three varieties, 95, 115, and 74, particularly the first two, will yield rich juice under favourable conditions.

The weight of cane yielded by some of the plots was very great, the greatest weight being given by No. 116, viz.. 146,168 pounds, or over 68 tons, consequently the yield of sugar per acre is also large in spite of the low quality of juice, but with the muscovado process, boiling the sugar in open pans, the process of manufacture would be unsatisfactory; indeed, it is doubtful whether some of the samples of juice would yield syrup which would granulate in the coolers.

The following notes were made of the condition of the canes in the field:—

No. 116—Kept well, arrowed freely first week in January, 1898.

,, 81—Badly laid, heavy top, much prickle on leaf, sheath arrowed first week in January.

China—Low, scrubly and tangled, arrowed second week in December, 1897.

No. 78—A very upright cane, sound, did not arrow.

,, 95—Suckered heavily, many unsound canes, arrowed third week in December, 1897.

,, 102—Upright cane, arrowed first week in December, 1897.

,, 89—Cane very much tangled, arrowed heavily first week in December, 1897.

,, 115—Upright cane, arrowed second week in December, 1897.

Po-a-ole—Badly laid, arrowed third week in December, 1897.

No. 74—Cane with heavy trash and many suckers; badly rotted. Did not arrow.

TABLE I.

Canes grown experimentally on Dank's Estate—Chapelton.

Name.	Weight of Canes per acre, pounds.	Gallons of Juice.	Beaumé.	Crushing, per cent. on weight of Canes.	Cane Sugar, pounds per gallon of Juice.	Composition of Juice, per cent. by weight.				Glucose Ratio.	Purity.	Cane Sugar in Juice, pounds per acre.	Rotten or Rum Canes, per cent. on sound.
						Total Solids.	Cane Sugar.	Glucose.	Non-Sugar.				
116	146,168	9,893	7·6	72·7	1·153	13·4	10·94	2·06	·40	18·8	81·6	11,405	6·3
81	146,124	9,857	7·6	71·1	1·145	13·4	10·86	2·15	39	19 9	79·2	11,290	5 4
China	98,340	6,851	8·5	73·9	1·464	15·0	13·80	1·39	—	10·1	92·0	10,030	8·8
78	94,424	6,281	8·5	70·6	1·448	15·0	13·65	1·27	·08	9·3	86·3	9,095	1·6
95	117,656	8,183	7·2	73·2	1·138	12·9	10·81	1·44	·65	13·3	83·8	9,305	24·2
102	1 5,996	7,346	7·8	73·2	1·254	13·8	11·87	1·58	·35	13·3	86·0	9,212	13·9
89	99,352	6,895	7·5	69·4	1·238	13·2	11·75	1·38	·07	11·7	89·0	8,554	12·8
115	106,436	6,974	7·7	69·2	1·160	13·7	10·75	1·97	·98	17·9	78·5	8,097	12·4
Po-a-ole	119,152	8,276	7·5	72·6	·928	11·5	8·86	2·52	·12	28·4	77·0	7,674	32 7
74	79,904	5,486	7·5	72·2	1·183	13·2	11·22	1·76	·22	15·7	67·5	6,487	54·4
Caledonian Queen 2nd Ratoons	48,048	2,883	10·5	64·6	1·886	13·6	17·52	·41	·67	2 7	94·2	5,438	None.

Rind fungus (*Trichosphæria sacchari*) was found in many cases, No. 74 was closely attacked by the Weevil Borer (*Sphenophorus sacchari*). In this connection it is important to note that the crop canes of the estate, chiefly *Caledonian Queen*, were very free from fungoid and insect parasites; amongst the canes in this mill yard it required some little search to discover a "bored" cane, one that had been attacked by the Moth Borer, so common in Barbados, the Windward and Leeward Islands. No evidence of rind fungus was seen in the Caledonian Queen canes.

This single series of experiments with these varieties should by no means be considered as final. It is probable that much better results might be obtained on a different site. The large proportion of rotten cane in some of the varieties is a most serious matter, particularly when the great loss sustained by some of the West Indian Colonies is remembered. Hitherto the canes of Jamaica have been free from serious pests. Specimens of the canes were sent to Kingston; when these were examined at the end of about eight weeks indications of rind fungus (*Trichosphæria*) were found on many of them. It is uncertain what significance attaches to this manifestation of rind fungus during the process of drying which the canes have undergone, but it is well to place the observations on record. The following table indicates the conditions of the canes after being kept for about eight weeks.

Signs of rind fungus on canes, about eight weeks after being cut:—

102, 116—Extensive.
81—Moderately extensive.
95, 115, 78—Fairly marked.
China—Slight.
74, 89, Po-a-ole—Free from visible signs.

Apropos of the above, which appeared in the *Bulletin of the Botanical Department, Jamaica*, Mr. J. H. Hart. Superintendent of the Botanical Department, Trinidad, makes the following remarks in the Trinidad Bulletin for July:—

In the Jamaica Bulletin for April, Mr. F. Watts, the Government Agricultural and Analytical Chemist, gives analyses of several varieties of sugar canes. Among these, are apparently one or two numbers distributed by the Demerara raisers, Messrs. Jenman and Harrison;

though from the want of the prefix letter, this is not certain. The value of the sucrose yield, as remarked by the analyst, is "exceedingly low"; and he finds it "difficult to account" for this fact especially as the canes were over 17 months old.

An examination of the analyst's notes shows that the canes "suckered heavily."

One of the badly laid canes gave 8·86 per cent. sucrose, while "a very upright cane, No. 78, gave 1,448 lbs. per gallon or 13·65 per cent. sucrose.

In Trinidad, our No. D. 78, which is taken to be the same cane as is in cultivation in Jamaica, gives a low yield of sucrose in comparison with D 95, D 74; D 115, D 116, and the Bourbon and others, while under the Jamaica treatment it was one of the highest, which appears to show that the conditions under which canes are harvested, and the condition of the canes themselves are factors to be very carefully considered when making comparisons between the growths made and crops reaped, on different soils and in different countries.

In the worn out soils and shady situation where we first commenced growing our seedling canes, a low sucrose yield was the rule, and this was observed for three successive years, but to-day, under the conditions of the open field, and a dry harvest season, this has been reversed, and the yield is now high, as will be seen in the analysis shortly to be published of the 1899 crop.

In making selection from seedling canes, one of our first rules is, that no cane "going down," *i.e.*, "badly laid," should be retained, as it has been found that whenever the cane reaches the ground there is a loss of sucrose and a gain in glucose percentages, and also where the cane "tillers"—*i.e.*, where the buds start into growth from the base of the cane upwards forming side shoots—the percentage of sucrose is decreased and the percentage of glucose increased. Weather has also a lot to do with the results obtained by analysis, for it is quite certain there is more water in the cane in wet weather than in dry, and consequently the percentage of sucrose will correspond or vary in accordance with rainfall. To make a direct comparison of results of analyses in different colonies, the weather for at least four months previously, and at the time, should be carefully registered.

There is one curious heading in Mr. Watts' table which might strike some of our planters. This is "Rotten or Rum Canes." Now I

remember being once hotly attacked at a meeting of the Agricultural Board in 1892 for stating that rotten canes were used for making rum; and it was somewhat sarcastically suggested that "Rum could not be made from vinegar." It seems, however, that rotten canes are still in use in Jamaica for this purpose, or such an excellent chemist as Mr. Watts would not have made a column for registering the percentage. If the rottenness is due to a fungus, and that fungus is one of the many known to produce flavouring matters, it may be remotely possible that the celebrated flavour of Jamaica rum is owing to this cause.

In Trinidad, the rind fungus is generally present more or less, and cane fields which do not show a single rotten cane may be found to be infected, if they are carefully examined. It has been shown that *Trichosphæria sacchari* is an organism which can exist as a *saprophyte*, but in certain seasons and under certain conditions, it appears as a *parasite* also. Canes left to dry in a laboratory almost invariably develop *Trichosphæria*, the chains of *macroconidia* being found in the dried-up inner cells, while the *microconidia* or Rind Fungus developes from pustules in the "rind" itself. One of the best signs of its presence (to the naked eye) is the red coloration of the leaf sheath of the cane. The fungus may exist throughout a field, and yet not a single cane be destroyed—but given the weather, the season, and certain conditions of the land, and the fungus will enter the canes and destroy a large percentage from each stool, sometimes as much as 50 per cent. of the crop upon the ground, as seen in Mr. Watts' return.

A study of the organism shows that it enters the cane at the base of the leaf stalk, and pierces the node or joint at the tender points which exist in this part. It follows, therefore, that those planters who keep their canes well cleaned or "trashed" in moist weather, may expect to suffer less than those who allow the accumulated leaf sheaths to rot and fall of their own accord. Entry by the borer cannot be guarded against so effectively, but even the borer will be found in most instances to enter the cane under the protection of the leaf sheath. The planter who leaves large quantities of rotten and fungus infested canes upon the ground, and treats them rather as good manure than as material to be destroyed, is certainly one who may expect an attack of *Trichosphæria* when the season is a suitable one for its development.

The immunity which is described by Mr. Watts as pertaining to the Caledonian Queen cane is a marked feature, and one which has already been duly recognised by cane raisers. Let a cane be ever so fine, ever so sweet—it still must be condemned for cultivation purposes if it shows a tendency to acquire disease of any kind, and especially if it shows a tendency to favour the spread of *Trichosphæria sacchari*. The qualities of a good cane may be estimated from the following stand-points of a cultivator and manufacturer :—

1. Good cropper. 2. Upright grower—does not fall. 3. High sucrose yield. 4. High vitality. 5. Non-liability to disease. 6. Fair fibre in megass and medium percentage of it. 7. High percentage of juice. 8. Early maturity. 9. Easily crushed—"mills well." 10. Juice easily clarified. 11. Flinty rind. 12. Ratoons well.

About these points much might be said, but a few words will suffice. The first point no one will dispute. As to the second, it is fairly clear that a cane not liable to fall has numerous advantages over one which becomes badly "laid." The third point is a necessity, as no cane can be first rate without a high sucrose yield. A large yield of juice with a low sucrose yield is expensive, as so much more material has to be carted in, and so much more water evaporated. The fourth point, viz., high vitality, perhaps requires explanation. It has been found, when putting in various kinds of "plant canes," that the cuttings of one variety have much more vitality than those of another. I have in mind now six rows of selected canes. The first and what is said to be the best will require supplies to the extent of nearly 60 per cent. while the next variety will take only some 5 per cent. of supplies. This vitality is well seen in D 78. When this cane is planted, hardly a cutting fails to grow, while with others, blanks are variously numerous. The fifth point of "non-liability to disease," is one of great importance. The sixth point is essential where, as in Trinidad, the work of the factory is done by using megass only for fuel, and there should be a medium percentage of this material, or the cane could not stand in the field, (point 2) or go well through the mill, (point 9). The seventh point is obvious, for unless a paying percentage of juice is given there would be no profit. The tenth point is an essential one, for it is clear that it would be useless to grow canes that would not make good sugar. Point eleven—the flinty rind—not too thick—characterises a cane which defies borers ;

therefore this must be taken as a good quality—provided there is not too much of it—of which the grower must judge from practical experience. It will be seen therefore that there are twelve or more good qualities to be considered. There are just as many bad ones, if not more, which have to be studied by the cane raiser before he can make his selections properly. After all these are disposed of, there are still the elements of chance, choice, and prejudice, to be considered. I do not for one moment think that the canes I choose or select would all be chosen or selected by Messrs. Jenman and Harrison or by Messrs. Bovell and D'Albuquerque and *vice versa*—but in this I see the greater *chance* of reaching the end in view, which is, I take it, the raising of a set of canes suitable for various soils and various climates, many per cent. better than those now generally cultivated.

Our Trinidad seedlings this year are of the highest promise—and a decided improvement—so that it is to be hoped this state of things may steadily go on till we get the 20 per cent. yield which every planter would like to see.

Since the above remarks were written by Mr. Hart for the *Trinidad Bulletin of Miscellaneous Information,* we have received a report by the Government Analyst, Prof. P. Carmody, on

SEEDLING CANES IN TRINIDAD IN 1899,

and we call the special attention of our readers to the following extracts and summary of this interesting document. It must be premised, that the fact, already mentioned by the Superintendent of the Botanical Department, who has been conducting the experiments with seedling canes, that the soil and situation in which the earlier experiments were made were less favourable, and the climatic conditions quite other than those in and under which the seedlings of 1899 were produced, detracts very seriously from the value of any comparison of the chemical analyses of the 1899 crop with those of 1896, 1897, and 1898, and that consequently little instruction can be derived from any such comparison by anyone but the experimenter himself. The point of surpassing interest is that under conditions of "the open field and a dry harvest season" canes of such a high

sucrose content have been obtained, and we would venture to hope and believe that it may be possible so to cultivate and manipulate some of these canes as to render them permanently available for the planter. What this would mean we do not need to point out to anyone acquainted with sugar growing and manufacture.

Extracts from Report of the Government Analyst.

By direction of His Excellency, Sir Hubert E. H. Jerningham, K.C.M.G., the analysis of the canes grown in the Government experiment grounds was made this year, for the first time, at the Government Laboratory. From 1896 to 1898, while the experiments were in the initial stages, the analyses were made by Mr. Hart, the botanist in charge.

The method of working adopted was as follows:—

Samples of canes were cut daily between 8 and 9 a.m., and conveyed with the least possible delay to the Laboratory. Each day's analysis was completed between 1 and 2 p.m. Every care was exercised in taking representative samples from the field—a large and a small cane being selected alternately. From these a further selection was made at the Laboratory until the sample was reduced to a convenient weight. No inferior canes were taken from the field; and as only fully ripe canes were sampled, it is almost certain that the results given in these tables are higher than the actual yield from a total crushing would be. The analysis extended over a period of one month, during which practically no rain fell, and hot drying winds prevailed. To check the influence of this, three sets of samples were taken—at the beginning, middle, and end of the month—from the standards grown for comparison. The sucrose increase in the Caledonian Queen was very considerable within the short period of 25 days. From this it is certain that any canes similarly affected, and examined towards the latter end of the period, are more advantageously placed than those examined earlier. One could not fail to observe that all the canes yielding upwards of 20 per cent. of sucrose were received during the last three days. The Demerara canes were all examined during the first two days, and this may account to some extent for the comparatively low yield of these canes. Greater attention should be paid in future to any possible influence arising from this cause. The juice was extracted by double crushing in an ordinary hand mill.

General Table (A).

In this table the Trinidad seedlings are arranged consecutively according to numbers, and are followed by the Trinidad growths of seedlings of Demerara origin, by the two standard canes—the Bourbon and the Caledonian Queen—grown for comparison, and by a few others.

The results vary within wide limits. The sucrose content of a few of the seedlings is low, the majority give good averages, and a considerable proportion give high results. Apparently, it would be unsafe to condemn the worst section on the analysis of any single year; for, by comparing with last year's analysis, it will be found that some of the poor varieties of that year have very materially increased their sucrose content—in one case from 10·1 to 17·62 per cent. It would, therefore, be advisable to bear this fact in mind before discontinuing the cultivation of any variety.

Juices rich in Sucrose (Table B).

In this table will be found selected varieties from the general table. It contains nine seedlings with juices yielding upwards of 20 per cent. of sucrose, and twenty-nine others between 18 per cent. and 20 per cent. *Eighteen per cent.* has been adopted as the minimum limit for selected varieties—this amount being yielded by Caledonian Queen in the third analysis. Among the first nine in the table are to be found four seedlings from D 170. Twenty-three of the thirty-eight selected seedlings in this table yielded from 68 per cent. to 74 per cent. of juice. Caledonian Queen and Bourbon yielded respectively 69 per cent. and 73 per cent.

(Professor Carmody here remarks that complete figures of yield of cane per acre are wanting, which is certainly unfortunate. We have no knowledge of the circumstances, but are decidedly of opinion that it is most desirable for a report of this character to be drawn up jointly by the botanist engaged in carrying out the experiments and the chemist who makes the analyses, as has regularly been done in Barbados and Demerara.)

Demerara and Trinidad Growths of the same Varieties (Table C).

This table deals with some of the best types of Demerara seedlings, and compares the analytical results of Demerara and Trinidad growths. The figures are sufficiently divergent to merit the most careful consideration. It would have been very much more satisfactory if,

by concordant results, we could have proved that good seedlings in one colony were equally suited to the soil and climate of another. It would have stimulated the interest, and increased the confidence of planters in seedling canes.

In the table, the first line for each seedling contains the average results of four years (in one case three years), analyses of Demerara growths, and the following lines contain the results of each year's analysis of Trinidad growths of the same variety of seedling.

Trinidad growths are represented by those at Palmiste estate and at the Botanic Gardens, and for convenience, the results obtained at these two places are first compared:—

YEAR 1898.

	Juice per cent.		Sucrose.		
	Palmiste.	R. B. Gardens.	Palmiste Estate.	R. B. Gardens.	Difference per cent.
No. 61	66	60	19·78	11·00	8·78
,, 74	66	57	19·25	18·20	1·05
,, 78	69	65	16·87	13·70	3·17
,, 95	67	58	20·52	17·10	3·42
,, 145	65	61	20·10	13·40	6·70

These are large differences requiring investigation and explanation. The conditions of growth are known to be different as regards soil and the application of manure. On the Palmiste estate the young plants were manured with ashes and skimmings, but not highly. They received ordinary care. At the Botanic Gardens the soil is a poor clay and no manure is used.

Suggestions.

The aim of these experiments is to ascertain if a better cane can be produced than the Bourbon or the Caledonian Queen, or other standard variety. To be of any value, this question must be solved within a reasonable number of years, and to do this adequately and successfully the co-operation of the planters is indispensable in order that the experiments may be carried out on a wider basis than they have hitherto been.

The seedling canes have now reached that standard of superiority which justifies the Government in recommending planters to give them a limited trial on each estate. The canes would thus be simul-

taneously subjected to varying conditions of treatment, soil and season, and in one year (or at the most two years) twenty or thirty reports from different estates would decide the merits or demerits of any seedling. As yet we have had but little experience of what cane seedlings may do outside of the nurseries; and this experience must be obtained before any final decision can be arrived at as to the real value of the seedlings. If sufficient plants can be obtained at the Gardens, I am confident that the Trinidad planters will co-operate in any general scheme for the elucidation of results so deeply affecting their own interests. Hitherto the only seedling cane experiments reported from Trinidad estates are those from Aranguez and Palmiste.

An interesting comparison has this year been made on the Orange Grove estate between the yield from the Bourbon and the Caledonian Queen—the two standard varieties. The figures have been kindly supplied by Mr. Bert de Lamarre:—

	TONS PER ACRE. Average.	JUICE PER TON. Gals.	Degrees Brix.	Sucrose per cent.	Indicated Sucrose per acre.
					lbs.
Bourbon	24	149	17·99	13·93	5349
Caledonian Queen	32	124	18·50	15·74	6724
In favour of Caledonian Queen	..	..	..	..	1375

Results like these are useful and instructive; and similar co-operation in seedling cane experiments would rapidly advance our knowledge of the habits, character, and value of new varieties under the very varying conditions attending the growth of the ordinary canes on large estates. Experimental results become valuable for reference in subsequent years. For want of organisation they are often lost altogether. The excellent and extensive experiments at Aranguez were left incomplete because no arrangements had been made for a chemical analysis of the juice. The results on the relative merits of Bourbon and Caledonian Queen, obtained at Orange Grove, are not in accordance with the views usually held by planters. But to prove or disprove them, other experiments should be made on a different soil. These experiments are wanted; and it is hoped that the planters will give the necessary assistance.

Table A.

ANALYSIS OF SEEDLING CANES, 1899.

Canes from Seed harvested in 1895 and previously.

Cane.	Juice.									Sucrose Contents of Previous Years.		
	Per cent.	Specific Gravity at 80° F. / 80°	Degrees Brix.	Percentage of			Quotient of Purity.	Lbs. per Gallon.		1898.	1897.	1896.
				Sucrose	Glucose.	Non Sugar.		Sucrose.	Glucose.			
T 1	69	1·07132	17·30	14·88	1·28	1·14	86	1·59	0·12	14·9	12·31	17·01
T 2	70	1·07412	17·95	15·90	1·38	0·67	88	1·70	0·13	18·2	14·30	16·57
T 6	70	1·07230	17·50	15·10	2·18	0·22	86	1·61	0·21	13·5	14·0	..
T 8	70	1·07484	18·10	15·80	1·76	0·54	87	1·69	0·17	13·8	16·7	..
Canes from Seed harvested in 1896.												
T 18	69	1·07868	19·00	17·77	0·50	0·73	93	1·91	0·05	16·3	.	..
T 19	68	1·08526	20·45	19·39	0·27	0·79	94	2·10	0·02	20·0	..	..
T 21	67	1·08778	21·00	19·63	0·59	0·78	93	2·13	0·05	18·8	..	..
T 24	66	1·08572	20·55	19·19	0·68	0·68	94	2·08	0·06	17·8	..	..
T 26	60	1·07764	18·70	17·15	0·97	0·58	92	1·84	0·09	15·1	..	..
T 30	63	1·08126	19·55	18·54	0·49	0·52	95	2·00	0·04	18·3	..	..
T 36	65	1·08236	19·80	18·33	0·89	0·58	93	1·98	0·08	17·3	..	.
T 37	64	1·07684	18·55	16·44	1·14	0·97	89	1·76	0·11	14·4	..	..

CANE.	JUICE.									SUCROSE CONTENTS OF PREVIOUS YEARS.		
	Per cent.	Specific Gravity at 80° F. / 80°	Degrees Brix.	Percentage of			Quotient of Purity.	Lbs. per Gallon.		1898.	1897.	1896.
				Sucrose.	Glucose.	Non Sugar.		Sucrose.	Glucose.			
T 39	63	1·08500	20·40	19·20	0·60	0·60	94	2·08	0·06	17·5	..	..
T 49	61	1·08088	19·50	16·91	1·88	0·71	87	1·82	0·18	13·2	..	..
T 52	70	1·07026	17·05	14·60	1·54	0·91	86	1·56	0·15	13·5	..	..
T 54	72	1·08304	19·95	18·08	0·86	1·01	91	1·95	0·08	12·3	..	..
T 55	75	1·06936	16·85	14·51	1·76	0·58	86	1·55	0·17	12·2	..	..
T 57	72	1·06156	15·05	12·02	2·74	0·29	80	1·27	0·27	13·8	..	..
T 60	69	1·08060	19·40	18·12	0·65	0·63	93	1·95	0·06	16·6	..	..
T 61	67	1·07500	18·15	15·79	1·70	0·66	87	1·69	0·01	11·6	..	..
T 64	72	1·08128	19·55	18·06	0·88	0·61	92	1·95	0·08	17·5	..	..
T 66	71	1·07720	18·65	17·02	0·89	0·74	91	1·83	0·08	10·1	..	.
T 69	73	1·06608	16·10	13·77	1·97	0·36	85	1·46	0·19	11·7	..	..
T 71	69	1·08100	19·50	18·16	0·50	0·84	93	1·96	0·05	11·8	..	..
T 75	71	1·09168	21·90	20·99	0·24	0·67	96	2·29	0·02	16·5	..	..
T 76	74	1·08818	21·10	19·67	0·82	0·61	93	2·14	0·08	14·4	..	..
T 77	72	1·09446	22·50	21·41	0·23	0·86	95	2·34	0·02	18·3	..	..
T 79	71	1·07644	18·45	16·79	1·11	0·55	91	1·80	0·11	14·5	..	..
T 80	75	1·08158	19·60	17·62	1·17	0·81	90	1·90	0·11	10·1	..	..

T	81	68	1·07038	17·10	14·40	2·47	0·23	84	1·54	0·24	10·7	..	..
T	82	68	1·08290	19·90	17·51	1·33	1·06	88	1·89	0·13	13·8	..	..
T	83	70	1·09008	21·50	20·21	0·43	0·86	94	2·20	0·04	15·3	..	..
T	85	71	1·08572	20·55	18·13	1·70	0·72	88	1·96	0·17	14·5	..	..
T	87	67	1·09403	22·38	21·23	0·32	0·83	95	2·32	0·03	15·8	..	..
T	95	72	1·08368	20·10	19·32	0·40	0·38	96	2·09	0·04	16·6	..	..
T	98	62	1·06876	16·70	14·42	1·69	0·59	86	1·54	0·16	15·6	.	..
T	100	62	1·06766	16·45	11·46	4·37	0·62	70	1·22	0·43	8·6	..	..
T	100	67	..	..	11·47	4·97	..	..	..	0·49	..	..	..
T	102	65	1·07168	17·40	14·09	2·58	0·73	81	1·51	0·25	14·2	..	..
T	104	69	1·07148	17·30	14·58	2·32	0·40	84	1·56	0·23	16·2	..	..
T	105	62	1·07544	18·20	16·27	1·22	0·71	89	1·74	0·12	15·0	..	..
T	106	67	1·06378	15·60	12·92	2·18	0·50	83	1·37	4·21	13·5	..	..
T	107	64	1·07176	17·40	14·48	2·36	0·56	83	1·55	0·23	12·3	..	..
T	110	64	1·07366	17·80	16·74	0·54	0·52	94	1·79	0·05	15·7	..	..
T	111	63	1·08640	20·70	19·94	0·32	0·44	96	2·16	0·03	21·3	..	.
T	113	72	1·07246	17·55	15·20	2·10	0·25	87	1·63	0·21	13·8	..	..
T	114	70	1·07260	17·60	16·02	1·23	0·35	91	1·71	0·12	14·3	..	..
T	116	69	1·06264	15·30	12·84	1·87	0·59	84	1·36	0·18	14·7	..	..
T	118	72	1·05366	13·20	9·14	3·62	0·44	69	0·96	0·36	10·2	..	..
T	119	72	1·07556	18·25	16·95	1·19	0·11	93	1·82	0·11	11·8	..	..
T	120	66	1·07034	17·10	14·94	1·94	0·22	87	1·59	0·19	14·7	..	..
T	121	70	1·06920	16·80	15·29	1·13	0·38	91	1·63	0·11	14·4	..	.
T	125	66	1·07408	17·90	16·05	1·38	0·47	90	1·72	0·13	15·3	..	..

Canes from Seed harvested in 1897.

Cane.	Juice.									Sucrose contents of previous years.		
	Per cent.	Specific Gravity at 80° F. / 80°	Degrees Brix.	Percentage of			Quotient of Purity.	Lbs. per Gallon.		1898.	1897.	1896.
				Sucrose.	Glucose.	Non Sugar.		Sucrose.	Glucose.			
T 146	61	1·08664	20·75	19·65	0·34	0·76	95	2·13	0·03	..	..	..
T 146	59	1·08930	21·35	19·99	0·35	1·01	94	2·17	0·03	..	..	..
T 163	66	1·08166	19·60	17·29	1·05	1·26	88	1·87	0·10	..	..	..
T 164	61	1·08090	19·50	16·29	1·42	1·79	83	1·76	0·14	..	..	..
T 166	66	1·08086	19·45	17·83	0·86	0·76	92	1·92	0·08	..	..	..
T 167	64	1·06912	16·80	14·42	2·18	0·20	86	1·54	0·21	..	..	..
T 168	66	1·07654	18·50	17·17	0·56	0·77	93	1·90	0.05	..	..	..
T 169	64	1·07904	19·05	17·76	0·53	0·76	93	1·91	0·05	..	..	..
T 170	65	1·08212	19·75	18·67	0·49	0·59	94	2·02	0·04	..	..	..
T 171	66	1·08110	19·50	18·07	0·43	1·00	93	1·95	0·04	..	..	..
T 172	61	1·07608	18·40	16·36	0·75	1·29	89	1·76	0·07	..	..	..
T 173	61	1·07860	18·95	17·62	0·50	0·83	93	1·89	0·05	..	..	.
T 174	66	1·07356	17·80	16·01	0·80	0·99	90	1·71	0·08	..	..	..
T 175	73	1·07840	18·90	16·90	1·25	0·75	90	1·82	0·12	..	..	..
T 176	67	1·07702	18·60	16·34	1·09	1·17	88	1·75	0·10	..	..	..

T 177	65	1·08020	19·30	17·74	0·80	0·76	92	1·91	0·08	..	..	..
T 178	61	1·08220	19·75	17·13	1·02	1·60	87	1·85	0·10	..	..	..
T 179	70	1·07226	17·50	15·30	1·60	0·60	87	1·64	0·16	..	..	.
T 181	68	1·08724	20·90	19·40	0·66	0·84	93	2·10	0·06	..	..	..
T 182	68	1·08556	20·50	19·19	0·84	0·47	93	2·08	0·08	..	..	..
T 183	67	1·08360	20·10	18·12	0·94	1·04	90	1·96	0·09	..	..	..
T 184	63	1·08736	20·90	19·40	0·70	0·80	93	2·10	0·07	..	..	..
T 186	69	1·08018	19·30	18·08	0·65	0·57	94	1·95	0·06	..	..	..
T 189	67	1·09169	21·87	20·70	0·37	0·80	95	2·26	0·03	..	..	..
T 192	68	1·08900	21·30	20·09	0·32	0·89	94	2·18	0·03	..	..	..
T 193	66	1·08568	20·50	19·19	0·61	0·70	94	2·08	0·06	..	..	..
T 195	74	1·07620	18·40	15·49	1·97	0·94	84	1·66	0·19	..	..	..
T 197	74	1·08580	20·60	19·28	0·73	0·59	94	2·09	0·07	..	..	..
T 199	71	1·08062	19·40	17·74	0·98	0·68	89	1·91	0·09	..	..	..
T 200	71	1·07398	17·90	15·52	1·90	0·48	87	1·66	0·19	..	..	..
T 201	69	1·08460	20·30	19·11	0·76	0·43	94	2·07	0·07	..	..	..
T 202	69	1·09050	21·60	20·72	0·30	0·58	96	2·25	0·03	..	..	..
T 203	74	1 08708	20·85	19·88	0·34	0·63	95	2·16	0·03	..	..	..
T 204	71	1·09346	22·30	21·24	0·47	0·59	95	2·32	0·04	..	..	..
T 205	71	1·08592	20·60	19·57	0·41	0·62	95	2·12	0·04	..	..	..
T 206	72	1·08312	20·00	18·27	0·97	0·76	91	1·97	0·09	..	..	..
T 207	69	1·07926	19·10	16·99	0·86	1·25	89	1·83	0·08	..	..	..
T 208	71	1·09038	21·60	20·30	0·77	0·53	94	2·21	0·07	..	..	..
T 209	74	1·07306	17·70	16·11	0·95	0·64	91	1·72	0·09	..	..	..

Demerara Selected Varieties.

Cane.	Juice. Per cent.	Juice. Specific Gravity at 80° F. / 80°	Juice. Degrees Brix.	Juice. Percentage of Sucrose.	Juice. Percentage of Glucose.	Juice. Percentage of Non Sugar.	Juice. Quotient of Purity.	Juice. Lbs. per Gallon. Sucrose.	Juice. Lbs. per Gallon. Glucose.	Sucrose Contents of Previous Years. 1898.	Sucrose Contents of Previous Years. 1897.	Sucrose Contents of Previous Years. 1896.
D 61	71	1·06586	16·05	12·95	2·42	0·68	81	1·38	0·24	11·0	13·04	15·86
D 74	65	1·07500	18·10	16·47	1·01	0·62	91	1·77	0·10	18·2	13·43	12·76
D 78	58	1·07150	17·35	14·29	1·86	1·20	82	1·53	0·18	13·7	11·51	9·72
D 95	64	1·08284	19·90	18·76	0·63	0·51	94	2·03	0·06	17·1	14·17	..
		1·07928	19·10	18·32	0·65	0·13	96	1·97	0·06			
D 115	59	1·07672	18·50	16·20	1·29	1·01	88	1·74	0·12	14·4	..	..
D 116	62	1·07330	17·75	15·09	1·86	0·80	85	1·61	0·18	15·5	..	14·24
D 117	68	1·06362	15·55	13·37	2·06	0·12	86	1·42	0·20	13·1	..	..
D 130	67	1·06908	16·80	14·71	1·22	0·87	88	1·57	0·12	13·6	..	12·78
D 145	70	1·06796	16·50	14·24	1·66	0·60	86	1·52	0·16	13·4	..	14·67
D 170	68	1·06606	16·10	13·09	2·88	0·13	81	1·39	0·28	15·1	..	14·56
D 95	53*	1·08548	20·50	18·52	0·79	1·19	90	2·01	0·08	..	..	..
D 95	70½†	1·08300	19·95	18·51	0·49	0·95	93	2·00	0·05	..	..	..
D 95	58‡	1·08074	19·40	17·59	0·77	1·04	91	1·90	0·07	..	..	..

* Bottom of cane. † Middle of cane. ‡ Top of cane.

Bourbon	72	1·07164	17·40	14·48	2·30	0·62	83	1·55	0·23	12·8	..	12·52
,,	73	1·07024	17·05	14·50	2·10	0·45	85	1·55	0·21	..	..	..
,,	72	1·07204	17·45	14·82	..	..	85	1·59	...	..	..	..
				14·60*								
Cal. Qu.	69	1·07120	17·30	15·56	0·93	0·81	90	1·66	0·09	17·0	13·16	13·12
,,	69	1·07330	17·75	16·55	0·75	0·45	93	1·77	0·07	..	..	..
,,	73	1·08034	19·35	18·37	..	..	95	1·98	..	..	..	..
				16·82†								
Burke ..	73	1·07094	17·20	14·69	2·25	0·26	85	1·57	0·22	11·9	10·52	..
Japanese	60	1·08028	19·90	15·67	1·47	2·76	79	1·69	0·14	..	..	..

TABLE B.

ANALYSIS OF 39 SELECTED CANES, 1899.

SUCROSE 20 PER CENT. AND UPWARDS.

T 77	72	..	..	21·41	0·23	0·86	95	2·34	0·02	18·3	..	..
T 204	71	..	..	21·24	0·47	0·59	95	2·32	0·04	..	..	..
T 87	67‡	..	..	21·23	0·32	0·83	95	2·32	0·03	15·8	..	..

* Average for Bourbon. † Average for Caledonian Queen. ‡ Average of three Analyses.

CANE.	JUICE.									SUCROSE CONTENTS OF PREVIOUS YEARS.		
	Per cent.	Specific Gravity at 80° F. / 80°	Degrees Brix.	Percentage of			Quotient of Purity.	Lbs. per Gallon.		1898.	1897.	1896.
				Sucrose.	Glucose.	Non Sugar.		Sucrose.	Glucose.			
T 75	71	..	..	20·99	0·24	0·67	96	2·29	0·02	16·5	..	..
T 202	69*	..	..	20·72	0·30	0·57	96	2·25	0·03	..	..	..
T 189	67†	..	..	20·70	0·37	0·79	95	2·26	0·03	..	..	..
T 208	71	..	..	20·30	0·77	0·53	94	2·21	0·07	..	.	..
T 83	70	..	..	20·21	0·43	0·86	94	2·20	0·04	15·3	..	..
T 192	68	..	..	20·09	0·32	0·89	94	2·18	0·03	..	..	..
Sucrose 19 per cent. to 20 per cent.												
T 146	59‡	..	..	19·99	0·35	1·01	94	2·17	0·03	..	.	..
T 111	63‡	..	..	19·94	0·32	0·44	96	2·16	0·03	21·3	..	.
T 203	74	..	..	19·88	0·34	0·63	95	2·16	0·03	..	..	..
T 76	74	..	..	19·67	0·82	0·61	93	2·14	0·08	14·4	..	..
T 21	67	..	..	19·63	0·59	0·78	93	2·13	0·05	18·8	..	..
T 205	71	.	..	19·57	0·41	0·62	95	2·12	0·04	..	..	..
T 181	68	..	..	19·40	0·66	0·84	93	2·10	0·06	..	..	..
T 184	63†	..	..	19·40	0·70	0·80	93	2·10	0·07	..	..	..
T 19	68	..	..	19·39	0·27	0·79	94	2·10	0·02	20·0	..	.

* Average of two Analyses. † Average of three Analyses. ‡ Low percentage of juice.

T 75	72	..	..	19·32	0·40	0·38	96	2·09	0·04	16·6	..	..
T 197	74	..	..	19·28	0·73	0·59	94	2·09	0·07	..	..	..
T 39	63*	..	..	19·20	0·60	0·60	94	2·08	0·06	17·5	..	..
T 24	66	..	..	19·19	0·68	0·68	94	2·08	0·06	17·8	..	..
T 182	68	..	..	19·19	0·84	0·47	93	2·08	0·08	..	..	..
T 193	66	..	..	19·19	0·61	0·70	94	2·08	0·06	..	..	..
T 201	69	..	..	19·11	0·76	0·43	94	2·07	0·07	..	..	..
				Sucrose 18 per cent. to 19 per cent.								
D 95	64	..	..	18·76	0·63	0·51	94	2·03	0·06	17·1	14·17	..
T 170	65	..	..	18·67	0·49	0·59	94	2·02	0·04	..	..	..
T 30	63*	..	..	18·54	0·49	0·52	95	2·00	0·04	18·3	..	..
Cal. Qn.	73	..	..	18·37	..	..	95	1·98	..	17·0	13·16	13·12
T 36	65	..	..	18·33	0·89	0·58	93	1·98	0·08	17·3	..	..
T 206	72	..	..	18·27	0·97	0·76	91	1·97	0·09	..	..	..
T 71	69	..	..	18·16	0·50	0·84	93	1·96	0·05	11·8	..	..
T 85	71	..	..	18·13	1·70†	0·72	88	1·96	0·17	14·5	..	..
T 60	69	..	..	18·12	0·65	0·63	93	1·95	0·06	16·6	..	..
T 183	67	..	..	18·12	0·94	1·04	90	1·96	0·09	..	..	..
T 54	72	..	..	18·08	0·86	1·01	91	1·95	0·08	12·3	..	..
T 186	69	..	..	18·08	0·65	0·57	94	1·95	0·06	..	..	.
T 171	66	.	..	18·07	0·43	1·00	93	1·95	0·04	..	..	..
T 64	72	..	..	18·06	0·88	0·61	92	1·95	0·08	17·5	..	..

* Low percentage of juice. † Glucose rather high.

Table C.

Comparison of Demerara and Trinidad growths of the same Seedling Canes.

Place.	Tons per Acre.	Juice.				Lbs. per Gallon.		Reported by	Year.
		Per cent.	Specific Gravity.	Per cent. Sucrose.	Quotient of Purity.	Sucrose.	Glucose.		
No. 61.									
Demerara..	21	67·2	1·089	18·40	87·2	2·014	·083	Harrison..	4 yrs. average.
Trinidad—Palmiste	20	66·2	1·090	19·78	91·2	2·158	·019	Holloman	1898.
,, R. B. Gardens.	..	60·6	1·067	11·00	67·4	1·278	·133	Hart ..	1898.
,, ,,	34	69·8	1·060	13·04	81·5	1·383	·093	,, ..	1897.
,, ,,	..	63·4	1·072	15·86	86·6	1·701	·103	,, ..	1896.
,, ,,	..	71·0	1·065	12·95	81·2	1·380	·242	Carmody..	1899.
No. 74.									
Demerara..	24	63·9	1·090	19·30	90·9	2·104	·055	Harrison..	4 yrs. average.
Trinidad—Palmiste	..	66·8	1·086	19·25	93·0	2·091	·038	Holloman	1898.
,, R. B. Gardens.	..	57·7	1·080	18·20	94·3	1·973	·042	Hart ..	1898.
,, ,,	43	64·0	1·061	13·43	81·0	1·425	·090	,, ..	1897.
,, ,,	..	62·5	1·063	12·76	78·7	1·357	·090	,, ..	1896.
,, ,,	..	65·0	1·075	16·47	90·4	1·770	·101	Carmody..	1899.

No. 78.									
DEMERARA	36	66·7	1·081	17·1	88·0	1·850	·058	Harrison..	4 yrs. average.
TRINIDAD—Palmiste ...	30	68·9	1·080	16·87	87·4	1·822	·109	Holloman	1898.
,, R. B. Gardens.	..	65·4	1·066	13·7	76·1	1·466	·110	Hart .	1898.
,, ,,	..	68·3	1·056	11·51	83·4	1·216	·257	,, ..	1897.
,, ,,	..	67·5	1·057	9·72	68·9	1·028	·176	,, ..	1896.
,, ,,	..	58·0	1·071	14·29	82·6	1·531	·186	Carmody..	1899.
No. 95.									
DEMERARA..	28	70·4	1·092	19·6	89·6	2·147	·049	Harrison..	4 yrs. average.
TRINIDAD—Palmiste ...	31	67·2	1·086	20·52	94·5	2·229	·019	Holloman	1898.
,, R. B. Gardens.	29·8	57·9	1·076	17·10	83·3	1·842	·029	Hart ..	1898.
,, ,,	..	70·4	1·064	14·17	90·8	1·508	·121	,, ..	1897.
,, ,,	.	64·0	1·082	18·76	95·2	2·032	·063	Carmody..	1899.
No. 145.									
DEMERARA..	27	70·3	1·086	17·7	85·8	1·923	·059	Harrison..	3 yrs. average.
TRINIDAD—Palmiste	32	65·3	1·088	20·10	95·2	2·187	·014	Holloman	1898.
,, R. B. Gardens.	..	60·8	1·067	13·40	82·2	1·435	·124	Hart ..	1898.
,, ,,	..	62·5	1·067	14·67	85·7	1·566	·095	,, ..	1896.
,, ,,	..	70·0	1·067	14·24	87·3	1·521	·166	Carmody..	1899.

FRANCE.

Results of the Campaign of 1898-99.

The number of factories at work during the season which closed on 31st August last was 344, against 344, 358, and 356 during the three preceding seasons.

The quantity of beets worked up was 6,105,614 metric tons, against 6,401,088 in 1897-98, and 6,765,000 in 1896-97.

The sugar production (in refined sugar value) is calculated at 701,635 metric tons, against 693,711 tons in 1897-98, and 633,399 tons in 1896-97.

The yields (also in refined value) obtained during the last four seasons were—in percentage of the weight of beets:—

1898-99.		1897-98.		1896-97.		1895-96.
11·49	..	10·84	..	9·36	..	10·42

GERMANY.

Results of the Campaign of 1898-99.

The number of factories at work during the season which closed on the 31st July last was 402, against 402, 399, and 396 in the preceding seasons.

The quantity of beets worked up was 12,144,291 metric tons, against 13,697,891 in 1897-98, and 13,721,601 in 1896-97.

The sugar production (in raw sugar value) including the sugar extracted from molasses, was:—

1898-99. Metric Tons.		1897-98. Metric Tons.		1896-97. Metric Tons.
1,717,973	..	1,844,399	..	1,821,223

The yield obtained was 13·36 per cent., against 12·79 per cent. in 1897-98, 12·66 per cent. in 1896-97, and 13·11 per cent. 1895-96, the present being the highest percentage yet obtained.

The exports, still in raw sugar equivalent, were:—

1898-99. Metric Tons.		1897-98.* Metric Tons.		1896-97.* Metric Tons.
1,010,286	..	1,041,801	..	1,237,521

* By some inexplicable oversight, these figures were quite inaccurately given in October *Sugar Cane* of last year.

The inland consumption, in raw sugar equivalent, amounted to:—

1898-99. Metric Tons.		1897-98. Metric Tons.		1896-97. Metric Tons.
755,184	..	708,237	..	561,882

The consumption per head of population is given as:—

1898-98. lbs.		1897-98. lbs.		1896-97. lbs.		1895·96. lbs.
30·16	..	28·75	..	23·16	..	31·15

This is also, be it noted, in raw sugar equivalent. By deducting one-eleventh, the quantity in refined sugar as consumed will be approximately obtained.

AUSTRIA-HUNGARY.

Results of the Campaign of 1898-99.

There were 214 factories at work, against 216, 217, and 216 respectively for the three preceding seasons.

The quantity of beets worked up was estimated at 7,611,500 metric tons, against 6,865,000 in 1897-98, 7,870,000 in 1896-97, 5,760,000 in 1895-96, and 8,530,000 tons in 1894-95.

The sugar production, in raw sugar value, for the last four campaigns was:—

1898-99. Metric Tons.		1897-98. Metric Tons.		1896-97. Metric Tons.		1895-96. Metric Tons.
1,039,022	..	821,694	..	929,901	..	781,036

The yields obtained (in percentage of weight of beets) were:—

1898-99.		1897-98.		1896-97.		1895-96.
13·65	..	12·00	..	12·00	..	13·50

Exports for the three past seasons, in metric tons:—

1898-99.		1897-98.		1896-97.
719,018	..	493,440	..	564,536

In a leading article in the *Journal des Fabricants de Sucre* of the 11th October, Mr. Dureau notes as follows the effect on the export of sugar from Mauritius of the countervailing duties levied in the United States and in India, as follows:—

	Exports from Mauritius in 1896-97. Tons.		1897-98. Tons.		1898-99. Tons.
To the United States	12,369	..	12,291	..	44,574
To India	77,285	..	62,187	..	96,493

A NEW ADJUSTABLE POLARISATION APPARATUS, WITH THE SCALE ON THE QUARTZ-WEDGE.

Under the above title we gave, in our August number, a translation of a pamphlet sent us by the inventor, Dr. G. Bruhns, of Cologne. In a short article on "Modern Polariscopes," published in our issue for last month, the author, Mr. George Stade, referred to a communication from Dr. F. F. Martens, of Berlin, which we have since received, and of which we now supply a translation. It is only fair to state that Dr. Bruhns has already replied to the strictures of Dr. Martens, and in due time and as space allows, we shall also supply a translation of that reply.

A short time ago Dr. Bruhns gave a description of a new quartz-wedge compensation arrangement for the polariscope, in which the scale is marked on the movable quartz-wedge itself, and he exhibited at the general meeting of the Union of German Sugar Technologists a polariscope manufactured by C. Reichert and supplied with the new arrangement. The purpose of the following communication is, firstly, to point out some disadvantages of the new construction; secondly, to indicate the true value of the advantages claimed by Dr. Bruhns; finally, to establish the real reason why up to now no polariscopes—whether fitted with the new or the ordinary wedge compensation—are capable of complete verification.

I.

Disadvantages of the Bruhns Wedge-Compensation.

1. The method of putting the scale of a polariscope on the movable quartz-wedge carries with it two special disadvantages. To begin with, it must be practically impossible to apply the method to double wedge-compensation, in which two wedges are movable for measuring purposes. Dr. Bruhns' opinion as to the value of double-wedge compensation I am unable to share. This method has the unquestionable advantage of being applicable also to polarising lævo-rotating solutions, and also of a more simple correction of the zero point of the working wedge by movement of the controlling wedge than by that obtained by moving the nonius. Further, any observer can, without being in possession of a set of normal quartz plates, himself ascertain whether his working wedge is provided with a correctly divided scale and optically pure. With regard to the latter advantage,

O. Schönrock* says: "If, on checking, by comparison one with the other, the two wedges for each five degrees we find the variations actually always under 0·03° Ventzke, it may be assented with great probability that the wedge compensation possesses no defects that need be taken into account, because it would be an extraordinary chance if the errors due to the optically imperfect places of one wedge were always exactly compensated by those of the other." When Dr. Bruhns asserts† with regard to double wedge-compensation that it possesses four reflecting surfaces more than single wedge-compensation, he shows but little acquaintance with the ordinary wedge-compensation. The double wedge-compensation is composed of the working wedge with the opposed wedge, and the control wedge with its opposed wedge, and hence possesses eight quartz surfaces; the single wedge-compensation consists of the working wedge with the opposed wedge and compensation plate, having therefore six quartz surfaces. The difference is, therefore, only two quartz surfaces, and not four, as asserted by Dr. Bruhns.

2. There are material difficulties in the way of the technical construction of a correctly-graded polariscope of the new kind.

The endeavour might be made to determine the wedge angle accurately, and to calculate therefrom the length of the grading. But if the division is to be accurate up to 1/100° Ventzke, the wedge angle must be accurately determined to one micromillimetre, which is practically impossible. Further, we have to take into account, in addition to the specific rotation of the quartz, the space between the wedge and the opposed wedge. Finally, the wedge angle, owing to the varying thermal extension of quartz, both vertically and in a direction parallel to the axis, is notably dependent on the temperature. For these reasons this proceeding is unreliable. There remains only one similar proceeding, as applied in the ordinary polariscopes. In this, a normal scale is screwed on the slide which carries the wedge, and with the aid of a good normal quartz plate of about 100° Ventzke, the difference is determined between the normal scale and the special accurately correct scale, for the wedge which is being examined. The latter is then completed, and screwed on the slide, without the wedge having to be taken out of the slide. But in order for the divisions

* O. Schönrock, Apparat und Methode zur Bestimmung der spezifischen Drehung. Part IV. in H. Landolt's "Das optische Drehungsvermögen," 2nd edition. Brunswick: F. Vieweg & Son, 1898, page 342.

† *Centralblatt für Zuckerindustrie*, VII., 1899, page 904.

thus determined to be put on the quartz wedge itself, it must be taken out of its frame, which is dangerous, as it will be difficult to bring the applied surface of the wedge again into exactly the old position. When the division is made, the completed slide must again be examined by means of the normal quartz plate, and it often turns out, that the division is distinctly inaccurate, sometimes even to the extent of 1 to 2 degrees Ventzke. The nicolin scale is at once ground clean, and a new division made. Now, a quartz wedge that has once been incorrectly graduated, cannot very well be provided with a fresh scale. The only course is then to use the polariscope with a not quite accurate 100 points, and to correct the observed values by means of a table of errors which has to be specially drawn up. Dr. Bruhns recommends this latter method of proceeding.*

This correction of the observations by means of a table of errors appears much too elaborate for technical use and also totally unnecessary, as it would be quite possible, by the use of pure quartz wedges in the simple way already described, to produce accurately graduated polariscopes of the ordinary construction.

3. Besides these disadvantages in principle, the apparatus described by Bruhns possesses two gross but easily avoidable defects. Dr. Bruhns proposes to graduate the nonius on the opposing wedge, and to shift the nonius by means of a special key until, when the apparatus is empty, the zero point of the nonius corresponds with the zero point of the scale. But shifting of the nonius and opposing wedge *together* effects no change whatever in the zero point, because we should afterwards have to shift the quartz wedge by exactly the same distance in order again to produce an equal obscuration of both fields. But in every polariscope the possibility of adjusting the zero point must be provided for. Hence the graduation of the nonius on the opposing wedge is totally impracticable.

And in one other respect also the graduation of the opposing wedge is inapplicable; it would render the construction of a polariscope unnecessarily difficult from a technical point of view. Dr. Bruhns proposes to graduate those surfaces of the wedge and the opposing wedge which are perpendicular to the axis. The rays of light must of necessity run through the wedge parallel with the optical axis of the quartz and hence vertical to the graduated surfaces, and outside the wedge parallel with the axis of the polariscope. On the external

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* *Centralblatt für Zuckerindustrie*, **VII.**, 1899, pages 648 and 649.

surface of the wedge the rays are diverted by 1·5° (angle of incidence in the case of quartz 3°, in the air 4·5°, difference 1·5°), the graduated surfaces are therefore inclined to the axis of the polariscope by 90 ± 1·5°. The shifting of the long wedge must not remove the graduated surfaces from one another, because of the parallax which would thereby ensue, and hence must be effected in the direction of the graduated surfaces. *Hence the movement of the long wedge must not take place perpendicularly to the axis of the polariscope, but must be inclined to it by 90 ± 1·5°*, and this increases the technical difficulty of construction to a very considerable extent. If this inclination is omitted, there results a disturbing illumination of the entire field of view, by which the delicacy of the determination is very much diminished. I am not aware whether or no this great mistake is made in the case of the Bruhns polariscope. Perhaps the remark of Dr. Bruhns regarding the apparent greater illumination of his wedge-compensation may be accounted for in this direction.

4. The illuminating arrangement, *i.e.*, the lenses placed between the illuminating medium and the polariser, is, further, also unsuitable.*

5. Dr. Bruhns makes a mistake in saying:—"Something, although after all only a little, has already been done in the way of control, by the normal quartz plates. As a matter of fact everything has, by means of the normal quartz plates, been done for the control of polariscopes; only by the use of good normal quartz plates is it possible to construct polariscopes with accurately corresponding 100 points.

II.

On the supposed Advantages of the Bruhns' Wedge-Compensation.

6. Dr. Bruhns considers as an important advantage of the new wedge-compensation, the fact that the illumination of the graduation in the case of dark sugar solutions diminishes *pari passu* with that of the fields of comparison. Myself, I consider it quite as advantageous that the gradation should always be equally and suitably illuminated. Any way, even in the case of the ordinary arrangements for reading

* For the correct direction of light rays, see F. Lippich. For methods of measuring polarised rays, see Proceedings of the Royal Academy of Science, Vienna (Sitzungsbericht der Kgl. Akademie der Wissenschaften, Wien, Math-naturw. Klasse, 1885, 91, IIa., 1059–1096). F. F. Martens, Zeitschrift für Instrumentenkunde, 1898, 18, 335–337. Franz Schmidt und Haensch, Katalog I., Polarisationsapparate und Saccharimeter S. 2, 1899.

off, the illumination of the scale can easily be diminished by turning the illuminating mirror, by interposing a slip of tissue-paper or something of the kind.

7. Nicolin scales are usually illuminated by the lamp used in observation by means of a slanting mirror and are read off from a second mirror. Just lately Josef and Jan Fric have attached a glass scale to the movable slide, which is observed in transmitted light. Both these arrangements appear to me to be no more complicated than that of Bruhns, in which a revolving arrangement and an illuminating quartz plate are required.

8. The following are the requisite conditions in fastening the wedge in the movable slide. If the wedge itself is graduated, it must not move between the time of setting and the reading off of the result. If the slide is provided with a nicolin scale, the wedge must not move between the two operations of setting the instrument when empty and inserting the observation tube. Further, in both constructions the wedge must not tilt to any observable extent, that is, the surface vertical to the axis must always lie in exactly the same plane. Above all the wedge, during the process of adjustment by means of a normal scale, must always be well fixed in its frame.

9. Dr. Bruhns says:—"The variation in the data obtained by the polarising apparatus hitherto in use resides, according to experience, principally in the variation of the scales and their relative movement as regards the quartz wedge to which they belong." This assertion I consider to be incorrect as regards fact, and totally unproven. Unfortunately Dr. Bruhns omits to inform us where such experience has ever been acquired.

If, during the lapse of time—*e.g.*, by mechanical action—the nicolin scale should have become shifted as regards the quartz wedge, such a movement, so long as the length of the scale remains unaltered, only changes the zero point of the apparatus. Now we can easily render ourselves independent of the zero point by making a trial with the empty apparatus before making the observation with the solution inserted. The movability of the nicolin scale as regards the quartz wedge therefore leads to no error in the case of careful observation, and hence does not stand in the way of the capability of testing a polariscope of the ordinary construction.

10. In regard to both constructions there are still other points to be considered, which might lead to variation of the zero point. Of these there is, first of all, a variation in the distribution of the lighting

from the source of illumination in the case of not quite accurate direction of the rays. Moreover, variations of the zero point may occur through shifting of the nonius as regards the opposing wedge—a circumstance which is regularly used for correcting the zero point—owing to feeble rotation of the polariser and analyser one with the other, and finally also—with the Lippich Polariser—in case of considerable change in the colour of the illuminating source. Whilst with the Bruhns arrangement any shifting of the scale as regards the wedge is certainly excluded, the above-named causes of variation in the zero points are present in the same manner as with the ordinary wedge-compensation. Practically only one of these reasons needs to be considered, viz.: variation of the distribution of the lighting from the source of illumination. Hence it may be rightly said: *The zero point of the Bruhns' Polariscopes is no more constant than that of the ordinary constructions.*

11. As regards the assertion of Dr. Bruhns relative to the variation of the scales, no one can really believe that moisture of the atmosphere can in any way effect the length of either nicolin scale or quartz wedge, and so we have only to deal with the difference of extension due to temperature. This difference with a variation of temperature of 10° C. only alters the 100 point of a polariscope by 0·005° Ventzke,* and practically may be completely ignored.

III.—As regards the Feasibility of Testing Polariscopes.

12. In order that the readings of various polariscopes may be exactly the same, it is necessary (1) that the direction of the rays of light shall be perfectly correct, (2) the polarisation shall be done at the same temperature, *e.g.*, 20° C., (3) the quartz wedges must be optically perfect, (4) the white light used must be made clear in the same manner, and (5) above all, the polariscopes must have exactly the same 100 point, *i.e.*, they must, with the same normal quartz plate of about 100° Ventzke rotation, give exactly the same rotation value.

The polariscopes of the ordinary construction can be made in accordance with these conditions. In these, care is taken to comply accurately with conditions 1, 3, and 5; the clearing of the white light (4) is effected by a solution of potassium bichromate of a given thickness of layer and concentration.

* The proof of this has so often been given that we do not repeat it here. See, for example, Schreiben der Physicalisch-Technischen Reichsanstalt u. s. w. "Zeitschrift des Vereins der Deutschen Zuckerindustrie, 1899," Part II., page 97, note.

From what has been said above in respect to the construction, it appears to be as yet doubtful whether a graduation which will be accurate in all cases can successfully be put on the quartz wedge itself.

13. After all, polariscopes whose 100 points agree with one another and which also in other respects comply with the above conditions, are in no way susceptible of being tested or verified. In order to do this, the common 100 point must be accurately correct for the normal weight selected, or a normal weight must be taken which exactly corresponds with the common 100 point of the polariscopes. Not until the rotation of pure sugar is more exactly known than is at present the case, and a new normal weight has been laid down in accordance therewith, can it be said of a polariscope that it has an accurately correct 100 point; and not until then will the possibility of verifying polariscopes be afforded.

INTRODUCTION OF FIRST-SUGAR SYRUPS INTO THE RAW SUGAR MASSE-CUITES.

(Otto Mittelstaedt in *Centralblatt fuer Zuckerindustrie.*)

The question of the addition of centrifugal syrups to raw sugar masse-cuites has now been so far decided, that it has become general to put, in one way or another, more or less green syrup into the masse-cuites, thus reducing the quotient of the mother-liquor far below the limits of purity which formerly obtained. It cannot be denied that the quality, the refining value, of the first sugar is frequently very unfavourably interfered with by this operation. This, however, can always be accounted for by incorrect manipulation. One fundamental mistake, especially, is very generally committed, as I have before now pointed out, viz., the omission to properly dilute, heat, and if possible mechanically filter the green syrup.

I may just remark that the method described below is not patented, and may be employed by anyone whatever, without payment, being founded entirely on my own observations, as can be proved at any time by reference to my former papers.

The green syrup is diluted with water from filtration, sweet water, or saturation juice to about 55° Brix., heated, and to each cubic metre of the mixture from 3 to 5 kilos. of barium hydrate, and about 10

kilos. of press scum are added. After saturation with sulphurous acid down to about 0·02 alkalinity, it is filtered mechanically through filter presses, and thus purified is drawn into the vacuum pan during the evaporation of the first-sugar masse-cuite. *The syrup thus taken in must be hotter than the boiling temperature in the vacuum pan*, Before adding the syrup, the masse-cuite should be boiled very close. down to about 4 per cent. of water, so as to induce as much as possible the crystallisation of the dissolved sugar. But after commencing the introduction of the syrup, the masse must be kept as open as possible, with about 12 per cent. of water. The boiling is finally completed at about 6 per cent. of water content, the masse-cuite is run into the crystallisers or Bock mixers or pug-mills, and the mass is maintained in continuous movement and allowed to crystallise out for at least 24 hours, during which it is cooled down to about 40° C., and then centrifugalled.

The raw sugars thus obtained have a very light colour and a high yield, and answer all commercial requirements; the masse-cuites centrifugal excellently, even when a large quantity of green syrup has been added, if only care be taken that the concentrated juice (Dicksaft), in which the grain is boiled out and formed, never exceeds 60° Brix., and that the masse-cuite is constantly kept as loose as possible during evaporation, by which means the free molecular movement and the contained energy of the masse-cuite, and consequently its capability of crystallisation are increased in the most simple way.

The small outlay for barium hydrate is very quickly compensated by the greater yield in first sugar.

To obviate any misunderstanding, I may be allowed to add my only reason for publishing the above remarks is that every raw sugar manufacturer may be placed in a position to deliver to the refiner a product that is really applicable to the purposes of technical refining.

The *Deutsche Zuckerindustrie* reports that a manufacturer of fruit syrups was lately condemned to a fine of 30 marks for adding starch-syrup to marmalade, which was regarded as an infringement of the law of 14th May, 1874, relating to food. It was held by the court that the public, in buying fruit marmalade, expected to get perfectly pure fruit juice and refined sugar.

ON RECENT ATTEMPTS TO DO AWAY WITH THE AFTER PRODUCTS.

BY RUDOLF HAFNER.

(Continued from page 521.)

III. Independent working up of the green syrups.

(a.) By free formation of grain.

(α.) Crystallization at rest.

By this I mean the ordinary tank or reservoir method of working hitherto in use, because with this the formation of crystals takes place as a consequence of the cooling of the masse-cuite whilst at rest. The syrups from the first product are, as is well known, boiled down to the second and eventually to the third product, and the runnings from this product are either directly separated as molasses from the working or subjected to osmosis. This method of working is the most tedious and expensive.

The working figures of a sugar factory are given here as an example of the yields by this antiquated mode of proceeding.

Of 100 parts of sugar in the beets were obtained :—

	Chemically pure sugar. Per cent.
In raw sugar, I. product	76·4
,, ,, II. product	5·1
,, ,, III. product	2·0
,, ,, IV. product (osmosis)	2·8
In all four sugars	86·3
In the water from osmosis and in the molasses	7·3
Total all products	93·6
The resulting loss being	6·4
	100·

As these figures correspond with the general average figures obtained in good working, they may serve as a standard for the comparison with those obtained by other methods.

(β.) Crystallization in movement.

(1.) *The Wulff-Bock Process.*

General remarks. In observing the crystallization of the evaporated masse-cuite in the ordinary reservoir for after-products, it will be noticed that soon after the filling in the top layer of syrup has

formed grain in consequence of the cooling. This very small grain sinks down and finally reaches the bottom, having grown larger and larger by assimilation of more sugar molecules that were just separating out. When once it has arrived at the bottom of the reservoir, it does not increase any more.

In this manner the syrup gradually parts with its sugar. The quotient falls, for example, from 77 to 66.

A syrup with a quotient of 66, could, if oversaturated, still deposit sugar molecules, if on the one hand the viscosity which prevents the separation of the sugar molecules could be got rid of, and on the other the molecular attraction between sugar and salts, by which a part of the sugar is held in solution, could be neutralised. Such a power is the attracting force of the sugar crystals themselves, for these, like any other body, attract their surroundings. It is in consequence of this power of attraction that they have increased in size on their passage from the upper layer of the syrup to the bottom of the reservoir. Each crystal at rest in the lower layers is surrounded by a sphere of already desaccharised syrup, and the power of attraction of the crystal is not sufficient to affect the remoter layers of syrup, which have a higher quotient of saccharine content.

Wulff and Bock, in their process, avoid crystallization at rest, and discard the stationary reservoir used therefor. They fill the masse-cuite into apparatus of their own construction, consisting of cylindrical drums either revolving on their longitudinal axis, or, if at rest, provided with a stirrer. Either by the rotation of the drum, or by agitation, the crystals lying at the lower part of the drum are carried onwards, and must pass through the whole of the syrup. This operation being continuous, the above-mentioned power of attraction is repeatedly brought into play in the masse-cuite, partly neutralising the attraction which exists between sugar and salts, and also partly overcoming the viscosity. The yields obtained by this method, as compared with those by the ordinary mode of working, are larger, and the time required for crystallization shorter. For obtaining the best possible results by crystallization, where the ordinary mode of tank working is used, just as many weeks are necessary as the Wulff-Bock method requires days. Wulff made these apparatus in varying forms and obtained letters patent for them in Austria, where the first twelve of the claims were struck out by the Minister of Commerce, the patent being limited to the last five claims.

(2.) Process of Paul Degener and W. Greiner.

(D.R.P. No. 85,072, of September 11th, 1894.)

The specification runs:—

1. Method for improvement of the crystallization of sugar massecuites, which consists in rotating the closed vessels, filled with the masses at 180°, the form of the vessel being so adapted that all crystals on the same level have to pass through the same length of sugar solution.

2. The isolation of the vessels mentioned in claim 1 by covering them with non-conducting material for the purpose of preventing cooling and the increased difficulty of motion of the crystals formed in the vessel produced thereby.

(To be continued.)

MONTHLY LIST OF PATENTS.

Communicated by Mr. W. P. Thompson, C.E., F.C.S., M.I.M.E., Patent Agent, 6, Lord Street, Liverpool; 6, Bank Street, Manchester; 322, High Holborn, London; and 118, New Street, Birmingham.

ENGLISH.

APPLICATIONS.

18306. H. B. Watson, J. S. Watson, and S. C. Billetop, Liverpool. *Improvements in or relating to tubes and the like heat transmitting surfaces, such as are used in heaters, evaporators, condensers, boilers, and the like.*" 11th September, 1899.

18515. B. Baron, London. *Improvements in supplying syrup or any other mixture with aerated beverages.* 13th September, 1899.

18573. J. F. Breuillard, London. *Improvements in vacuum-forming apparatus.* 14th September, 1899.

18737. A. J. Boult, London. (A communication by S. Heuclin, France.) *Improvements in or relating to presses.* 16th September, 1899.

18785. J. Sulley, T. Cole, and W. S. Cole, London. *An Improvement connected with chocolate and like confectionery makers' tables.* 18th September. 1899.

18979. H. Zoelly, London. *Improvements in or connected with turbine wheels.* 20th September, 1899.

19033. F. W. Dunlop, London. *Apparatus for evaporating and drying in vacuo.* 21st September, 1899.

19186. E. G. Scott, London. *Improvements in or connected with vacuum pans.* 23rd September, 1899.

19442. EDMUND R. GABBETT, London. *Apparatus for removing the solid contents of the baskets or drums of centrifugal separators or hydro-extractors.* 27th September, 1899.

20202. JOHN LAIDLAW and JAMES W. MACFARLANE, Glasgow. *Improvements in centrifugal machines.* 9th October, 1899.

20355. HERMANN FLESCHE, of the firm Action Gesellschaft für Verzinkerei und Eisen-Construction vormals Jacob Hilgers. *Improved process of manufacturing crystallised sugar or sugar candy, and apparatus therefor.* 10th October, 1899.

20405. WILLIAM J. ENGELDUE, London. *Improvements in or relating to the refining of sugar.* 11th October, 1899.

UNITED STATES.

ABRIDGMENT.

633785. J. C. BOOT, Klatten, Java. *Process of decolorising vegetable juices.* September 26th, 1899. This improvement is intended for employment in the art of decolorising syrups, molasses and vegetable juices generally. Such syrups, molasses or other vegetable juices have generally been decolorised with sulphurous acid (adding sometimes zinc to produce hyposulphurous acid). It is found in practice, however, that such decolorised juices in a brief time again turn darker, this being due, according to investigation, to iron salts contained in all juices of the class referred to. These iron salts, under the action of the oxygen contained in the air, cause the juice to become darker, and thus interfere with perfect and permanent decolorisation. The object of the present invention is to render the said iron salts innocuous, thus insuring a permanent decolorisation. In carrying out this invention, the syrups, molasses, or other vegetable juices of a concentration below 50° Brix are heated to about 50° C., and, under constant stirring, sulphurous acid alone or zinc and sulphurous acid are added. So far the process is substantially the usual one. The liquor is then heated to a temperature of, say, 80° C., and a soluble ferrocyanide is added till all the iron (or iron and zinc) is precipitated. The liquor is then filtered or decanted in order to free it from the precipitate of ferrocyanide of iron (and of zinc, in case zinc was used).

GERMAN.

ABRIDGMENTS.

103996. H. KEIL, Cöthen i. A. *Stationary shredding press actuated according to the counter-current principle.* 21st July, 1898. The shreddings are introduced through a worm or any other arrangement

suitable for the purpose which opens tangentially into the lower part of the press. After the shreddings have been pressed in the press in the usual manner they are discharged at the upper end of the hopper.

104114. H. PUTSCH & Co., Hagen i. W. *Knife boxes for shredding machines.* 25th October, 1898. (Addition to Patents No. 54549, 1890, and No. 88207.) An adjustable screw is so disposed in the journal of the knife bed that it forms a species of crank-arm by means of which the journal and thereby the whole of the knife bed can be rotated.

104115. GERLOFF & Co., Brunswick. *Method of producing lump sugar with the greatest possible amount of surface fractures.* 23rd November, 1898. Lumps of sugar are produced from a sugar loaf with the greatest possible amount of surface fractures by the sugar loaf being divided into slabs of the size of several lumps of sugar. These slabs are then cut up in two directions at right angles to one another in parallelipipedon bodies, these bodies are then again so divided that lumps of sugar of the desired size are formed.

104506. R. SAUERBREY, Stassfurt. *A multiple evaporating apparatus according to Patent 90071.* 21st September, 1898. The multiple evaporating apparatus according to Patent 90071 has been further improved, in that after the evaporating liquid has been conducted through the evaporators and arrives in the filter, it is again conducted to another evaporator. This evaporator is attached to the steam system, a higher vacuum being obtained in this latter evaporator than in the former, so that in this latter evaporator a still further evaporation is brought about without the introduction of of increased heat.

Patentees of Inventions connected with the production, manufacture, and refining of sugar will find *The International Sugar Journal* the best medium for their advertisements.

The International Sugar Journal has a wide circulation among planters and manufacturers in all sugar-producing countries, as well as among refiners, merchants, commission agents, and brokers, interested in the trade, at home and abroad.

Willett & Gray estimate the production of beet sugar for 1899-1900 at 110,000 tons, against about 40,000 and 32,000 tons respectively in 1898-99 and 1897-98. But for drought in the Pacific beet-growing districts the production would probably have been much larger.

IMPORTS AND EXPORTS OF SUGAR (UNITED KINGDOM).

To end of September, 1898 and 1899.

IMPORTS.

Raw Sugars.	Quantities. 1898.	Quantities. 1899.	Values. 1898.	Values. 1899.
	Cwts.	Cwts.	£	£
Germany	4,232,867	3,834,578	1,904,552	1,941,243
Holland	229,520	311,882	97,413	145,457
Belgium	804,090	1,033,327	356,591	510,413
France	1,914,652	1,044,968	962,337	594,065
Java	147,185	104,332	84,278	61,152
Philippine Islands	872,480	366,149	388,109	169,502
Cuba and Porto Rico	14,380	1,320	8,108	1,000
Peru	808,211	265,713	406,160	149,885
Brazil	425,057	55,365	201,828	28,752
Mauritius	21,920	111,300	10,552	53,718
British East Indies	294,180	546,573	126,583	276,317
British W. Indies, British Guiana, & Brit. Honduras	742,219	709,105	448,033	525,286
Other Countries	641,814	887,285	308,451	495,704
Total Raw Sugars	11,148,575	9,271,897	5,302,995	4,952,494
Refined Sugars.				
Germany	8,211,324	8,748,319	4,991,959	5,459,018
Holland	1,700,350	1,595,891	1,096,207	1,056,050
Belgium	301,378	274,434	190,974	178,535
France	1,995,882	1,764,059	1,217,836	1,116,063
United States	7,478	6,487	8,037	7,480
Other Countries	37,478	33,141	22,173	21,399
Total Refined Sugars	12,253,890	12,422,331	7,527,186	7,838,545
Molasses	897,985	1,129,478	229,592	274,203
Total Imports	24,300,450	22,823,706	13,059,773	13,065,242

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden and Norway	77,419	55,129	45,769	34,652
Denmark	95,909	127,730	49,032	74,254
Holland	83,971	78,673	47,369	49,516
Belgium	13,354	10,474	7,575	6,647
Portugal, Azores, &c.	59,818	53,361	32,280	31,318
Italy	29,170	14,446	15,528	8,567
Other Countries	161,748	136,128	94,671	84,198
	521,389	475,941	292,224	289,152
Foreign & Colonial Sugars.				
Refined and Candy	142,201	117,976	87,332	77,008
Unrefined	313,248	193,315	171,799	117,621
Molasses	221,868	74,659	67,664	24,533
Total Exports	1,198,706	861,891	619,009	508,314

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1899. Tons.		1898. Tons.
Total Receipts, 1st Jan. to 19th Oct. ..	1,459,048	..	1,105,824
Receipts of Refined ,, ,, ,, ..	1,779	..	23,964
Deliveries ,, ,, ,, ..	1,460,470	..	1,155,005
Consumption (4 Ports, Exports deducted) since 1st January	1,385,168	..	1,180,582
Importers' Stocks (4 Ports) Oct. 18th ..	3,901	..	19,535
Total Stocks, October 25th..	184,000	..	144,162
Stocks in Cuban, October 25th	14,000	..	37,500
	1898.		1897.
Total Consumption for twelve months ..	2,047,344	..	2,071,413

CUBA.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, 1898 AND 1899.

(Tons of 2,240lbs.)	1898. Tons.		1899. Tons.
Exports	221,195	..	289,511
Stocks	41,295	..	15,174
	262,490		304,685
Local Consumption (nine months)	36,600	..	28,600
	299,090		333,285
Stocks on the 1st January (old crop)	1,515	..	4,336
Receipts at Ports up to 30th Sept... ..	297,575	..	328,949

JOAQUIN GUMA.

UNITED KINGDOM.

STATEMENT OF NINE MONTHS' IMPORTS, EXPORTS, AND CONSUMPTION FOR THREE YEARS.

	1899. Tons.		1898. Tons.		1897. Tons.
Stock, 1st January	76,930	..	90,030	..	139,623
Imports, Raw Sugar, Jan. 1st to Sept. 30th	463,595	..	557,429	..	472,912
,, Refined, Jan. 1st to Sept. 30th..	621,117	..	612,694	..	571,272
,, Molasses, Jan. 1st to Sept. 30th..	56,474	..	44,899	..	45,539
	1,218,116		1,305,052		1,229,346
Stock, in 4 chief Ports, Sept. 30th	39,000	..	85,000	..	68,000
	1,179,116		1,220,052		1,161,346
Exports (Foreign, and British Refined) ..	43,089	..	60,935	..	68,431
Apparent Consumption for Nine months..	1,136,027		1,159,117		1,092,915

STOCKS OF SUGAR IN EUROPE AT UNEVEN DATES, OCTOBER 1ST TO 21ST, COMPARED WITH PREVIOUS YEARS.

IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	TOTAL 1899.
41	114	217	61	13	446

	1898.	1897.	1896.	1895.
Totals	495 ..	525 ..	722 ..	799

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING SEPTEMBER 30TH, IN THOUSANDS OF TONS.

Great Britain.	Germany	France.	Austria.	Holland, Belgium, &c.	Total 1898-99.	Total 1897-98.	Total 1896-97.
1620	766	592	385	448	3811	3725	3579

ESTIMATED CROP OF BEETROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE CURRENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1899-1900. Tons.	1898-99. Tons.	1897-98. Tons.	1896-97. Tons.
Germany	1,800,000 ..	1,721,718 ..	1,852,857 ..	1,836,536
Austria	1,070,000 ..	1,051,290 ..	831,667 ..	934,007
France	915,000 ..	830,132 ..	821,235 ..	752,081
Russia	870,000 ..	790,000 ..	738,715 ..	728,667
Belgium........	250,000 ..	235,000 ..	265,397 ..	288,009
Holland........	175,000 ..	149,763 ..	125,658 ..	174,206
Other Countries..	220,000 ..	170,000 ..	196,245 ..	202,990
	5,300,000	4,947,903	4,831,774	4,916,586

The estimates for 1899–1900 now given by Mr. Licht for the first time, must for the present be considered as only approximative.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

The record of the movements in our markets during the month of October presents but few features of interest. Apart from the usual fluctuations, prices have steadily declined, and are likely to close about 3d. per cwt. all round below those quoted in our last report. As regards refining sorts, though there was but a poor supply of cane, our refiners, in face of the large quantity of Continental granulated, &c., offering at low prices, have been unwilling to operate, and the unremunerative character of the British refining trade is clearly expressed in the determination of one of our oldest firms to close their works at Liverpool. The excess of the 1899-1900 beet production over that of the past season is estimated by Mr. Licht at about 350,000 tons, but there is a general feeling that 500,000 tons would be nearer the mark, and so the effect of the announcement on the market was quite transitory. Indeed, we cannot as yet accept any figures as to any extent a guide for the future, because all depends on the weather of the next few weeks. It is abundantly evident that the American refiners are as yet fully independent of the European sugar, and even the lower prices have not led to any transactions of moment.

Meanwhile the statistical position cannot be considered as otherwise than both strong and sound; consumption is increasing, and likely to continue so, stocks are lower than those to which we have always been accustomed, and it would therefore seem unlikely that we shall have any further decline of moment.

The following quotations are in all cases for prompt delivery :—

			Last Month.
Porto Rico, fair to good Refining	10/0 to 10/6	against	10/6 to 11/0
Cuba Centrifugals, 97°/。 polarization....	11/3 to 11/6	,,	11/6 to 11/9
Java, No. 14 to 15 D.S.	11/9	,,	12/0 to 12/3
British West India, fair brown	10/0	,,	10/6
Bahia, low to middling brown	9/9	,,	10/0
,, Nos. 8 and 9..	10/0	,,	10/3
Pernams, regular to superior Americanos.	9/9	,,	10/3
Madras Cane Jaggery	9/9	,,	9/9 to 10/0
Manila Taals	9/0	,,	9/3
French Crystals, No. 3, f.o.b.	10/1½	,,	10/7½
Russian Crystals, c.i.f..	10/9 to 11/0	,,	?
German granulated, f.o.b.	11/1½	,,	11/6
Tate's Cubes..	15/9	,,	15/9
Beet, German and Austrian, 88%, f.o.b...	9/1½	,,	9/6

THE

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Advertisements from those desiring employment are inserted Free of Charge. All Advertisements to be sent *direct.*

☞ The Editor is not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

We would call attention to Mr. Stein's Report on Beet Growing Experiments in England during 1899, which will be found in the present number.

Blyth Bros. & Co. report shipments of sugar from Mauritius from 1st August to 20th October, 1899, as 23,804 tons, against 29,174 tons in the corresponding period of 1898. Business still dull. Unfortunately the plague, which has somewhat abated in Port Louis, is extending in the country districts.

Exports from British Guiana from 1st January to 7th November:—sugar, 52,261¼ tons; rum, 999,646 gallons; molasses, 4,465 casks; cocoa, 124,778 lbs.; against 75,630 tons, 1,591,800 gallons, 3,015 casks, and 52,401 lbs. for the like period last year.

The French Government will bring in a bill prohibiting the use of saccharine and all similar artificial sweetening substances, except as medicine, under penalty of three months imprisonment and a fine of 500 francs. There is every reason to expect that the bill will pass into law.

The *Deutsche Zuckerindustrie* states that in Venezuela the duty on syrup and candy sugar has been increased from 75 cts. to 1·50 bol. (1½ franc), and the import of other sugars forbidden. This is in order to protect the home-made article. The value of the German sugar imported into Venezuela during 1895, 1896, and 1897 averaged £300,000 per annum.

SUGAR-BEET GROWING EXPERIMENTS IN ENGLAND IN THE YEAR 1899.

Conducted by SIGMUND STEIN, Technical Sugar Expert, Liverpool.*

In publishing the results of the experiments with Sugar-Beet growing in England in the year 1899, I am glad to say that the results obtained are even better than last year. It can be clearly seen that the farmers have gained experience, and that they have followed my advice and instructions in every way. I selected seed suitable for the district where the experimental growing was to be carried on, and the farmers have done better in the way of manuring. The results of this year's experiments are so encouraging that I propose to continue them during the coming year, and have already several letters from gentlemen who are willing to grow sugar beets for me next year. In the annexed tables I have compared the results of the English beet experiments with those obtained by Mr. F. O. Licht, at Magdeburg, as stated in analyses made about the same time.

The averages come out as follows:—

	Average Weight of Roots, with leaves, in Grammes.	Average Weight of Roots, without leaves, in Grammes.	Degrees Brix (dry matter).	Specific Gravity.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar, in 100 parts of the Juice.	Quotient of Purity.
Analysis of the English-grown Roots, 1899.	1944	949	19·00	1·079	16·30	2·70	85·78
German Roots (analysed by Mr. F. O. LICHT, 1899).	1159	611	18·30	1·076	15·45	2·85	84·42

This satisfactory outcome may be judged by comparing it with the experiments carried out last year under the auspices of the Central

* See *Sugar Cane*, 1898, pp. 518, 622, &c.; *International Sugar Journal*, 1899, pp. 29 86, 428.

Chamber of Agriculture, and reported in the Journal of the Board of Agriculture (June, 1899, Vol. 6, page 45) as follows:—

	Sugar in 100 parts of Juice.		Average quotient of Purity.		Average quantity of sugar in 100 parts of the Roots.
The English-grown Roots contained on an average (1898).	15·65	....	85·19	....	14·48

I have averaged and compared the data at my disposal relating to the yields in the different beet growing countries of Europe and the United States for the last seven years, which are as follows:—

	Sugar in 100 parts of the juice.	Average quotient of purity.	Average quantity of sugar in 100 parts of the roots.
Germany	15·08	86·24	14·20
Austria	14·11	84·90	13·40
Hungary	14·20	84·26	13·60
France	13·85	84·10	13·05
Belgium	15·31	87·85	14·37
Holland	13·99	85·57	13·23
Russia	14·26	86·66	13·70
Sweden	13·92	84·73	13·17
Spain	15·75	87·38	14·62
Roumania	15·26	87·13	14·36
Greece	11·49	82·77	11·00
Bulgaria	13·84	83·77	13·25
Italy	14·11	86·06	13·41
United States of America	14·56	83·91	13·88

On comparing this table with the figures stated above for the English-grown roots in the year 1899, it is clearly evident that England occupies a superior position in the growing of sugar beetroot. I have frequently stated that we can grow better roots than on the Continent of Europe, and many gentlemen who doubted my statement are now commencing to realize the fact. The time is not so very far distant when we shall see our sugar grown in our own country, and shall have our own sugar industry.

I cannot do better than repeat what I have already frequently stated in regard to the importance of the beet cultivation in England from the standpoint of political economy. By the introduction of this gigantic industry into these islands, we should immensely increase the activity of other industries connected therewith, and it must not be forgotten that the consumption in Great Britain and

Ireland is over one and a half million tons of sugar per annum, and if this were produced at home it would require nearly 400 factories, each of them employing inside their walls from 300 to 400 men and women, or a total of 160,000 hands.

Double this number would be employed in the fields, in the agricultural labours necessary for the production of the beets. The money value of the sugar produced would be about £15,000,000, which would remain in this country instead of being sent abroad to enrich foreign producers, and to support the other industries connected with the sugar industry.

If we consider that at least 150,000 men would find employment in the trades that work hand in hand with the sugar industry, we see that the latter would form an important link in the long chain of home industries whose welfare we have at heart. Trade as a whole would derive immense benefit, but the greatest boon would be to the rural population. That great immigration of the rural population into the towns, which now continually swells the number of the unemployed, would be checked, and the agricultural labourer would be tied to his village and would have plenty of employment, to the complete relief of many over-populated districts. There would very soon be a class of agricultural labourers who would become skilled labourers in the beet sugar industry, and would be employed in the summer in the fields, and in winter within the walls of the factories.

Of how great importance the sugar industry is to other industries may be seen from the following summary:—

If all the sugar were made at home, England would require 400 factories, each of which would cost on an average £50,000, so that £20,000,000 would be invested at home.

Of the above amount:—

Ten to twelve millions would go to various engineering works;

Three millions would go to brickmaking and building trades;

Two millions to smaller industries and trades;

Three millions for materials, bags, coals, coke, limestone, etc.

In addition to this, large sums would be spent every year for repairs, improvements, etc., probably between two and three millions sterling.

The total employment afforded would be as follows:—

	Men.
The sugar works would employ	160,000
Agricultural labourers and outside hands	200,000
Men employed in allied industries	40,000
	400,000

These 400,000 men would represent 300,000 families, which at four per family would mean that 1,200,000, or 3·2 per cent. of the whole population, would be directly interested in the sugar industry.

If these men were employed for six months only at £1 per week, £10,000,000 per annum would be paid in wages.

I am constantly receiving enquiries regarding the cost of a beet sugar factory, and the necessary working capital. It is difficult to make statements and to advise without knowing all the circumstances. It is of no use to start a scheme which is not well founded, has not sufficient working capital, and is not laid out to work up at least 200 tons of beets per day. Such smaller schemes, which are regularly coming to my knowledge, would be of no avail, and I could not, under any circumstances, advise starting in such a limited way.

In regard to this year's beet-growing experiments, I may finally remark that several other parcels than those named in the tables came to me for analysis. These roots also were analysed, but I cannot report on them, as I cannot trace the sender and have therefore no detailed particulars.

I have analysed these beet roots for glucose, and found in Reference No. 1, 0·09 per cent.; Reference No. 3, 0·21 per cent.; and Reference No. 9, 0·27 per cent. of glucose; none of the others contained any glucose, not even traces.

With regard to the amount of juice, the roots contained on the average:—

	Per cent.
Juice	93·26
Pulp	6·74
	100·00

As regards the tonnage per acre, the English-grown roots showed:—

	Tons of roots without leaves per acre.
In 1898	16·3
In 1899	16·9

Reference Number.	Trial made by	Farming at	Kind of Soil.	Manure used, and Quantity per English statute acre.	Kind of Seed.	Duration of Growth. Days.
1	John Woolston, Esq., J.P...	North Fields Farm, Stamford, Lincoln.	Loamy soil, clay subsoil	Farmyard manure; in the autumn.	Vilmorin Blanche..	131
2	Miss C. Penruddocke......	Compton Park House Farm, Salisbury, Wilts.	Light sand...........	7 loads of stable manure......	Schreiber Elite....	117
3	G. H. Morrell, Esq., M.P...	Headington Hill Wick Farm, Headington, Oxford.	Very light soil; subsoil, yellow sand lying on limestone.	12 loads farmyard manure	White Silesian	133
4	G. H. Morrell, Esq., M.P...	Headington Hill Wick Farm, Headington, Oxford.	Very light soil; subsoil, yellow sand lying on limestone.	12 loads farmyard manure	Sutton's Improved	133
5	G. H. Morrell, Esq., M.P...	Headington Hill Wick Farm, Headington, Oxford.	Very light soil; subsoil, yellow sand lying on limestone.	12 loads farmyard manure	Vilmorin Blanche..	133
6	The Right Hon. the Earl of Denbigh.	Newnham Paddox Estate, Lutterworth, Warwick.	Light loam, sand subsoil.	8 tons of lime, 8 cwt. dissolved bones (twice), and 4 cwt. nitrate of soda.	Mette Vilmorin ..	150
7	Rev. Edward Muckleston, M.A.	Haseley Rectory Glebe Farm, Warwick.	Sandy, sandy subsoil ..	None	Mette Klein Wanzleben.	147
8	W. J. C. Moens, Esq., J.P..	Tweed Estate Farm, Lymington, Hants.	Sandy loam, sand subsoil.	24 horse loads farmyard manure, and 8 cwt. artificial manure, viz.:—2 cwt. sulphate of ammonia, 4 cwt. dissolved bones, 1 cwt. salt, 1 cwt. gypsum.	Vilmorin Blanche..	161
9	W. J. C. Moens, Esq., J.P..	Tweed Estate Farm, Lymington, Hants.	Light sandy, gravel subsoil.	Ditto ditto	Vilmorin Blanche..	161
10	W. J. C. Moens, Esq., J.P..	Tweed Estate Farm, Lymington, Hants.	Stiff loam, clay subsoil.	Ditto ditto	Vilmorin Blanche..	161
11	The Oxford Corporation ..	Minchery Sewage Farm, Sandford-on-Thames, Oxford.	Sand and peat	Sewage	Russian "Klein"..	186

Reference Number.	Previous Crop.	Yield of Roots per acre, in Tons, fractions omitted.	Average Weight of Roots, with leaves, in Grammes.	Average Weight of Roots, without leaves, in Grammes.	Degrees Brix (dry matter).	Specific Gravity.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Quotient of Purity.	Quantity of Sugar in 100 parts of the Roots.	Compared with Analyses of German-grown Roots, round Magdeburg, by Mr. F. O. LICHT, on similar dates. Average Weight of Roots, with leaves, in Grammes.	Average Weight of Roots, without leaves, in Grammes.	Degrees Brix (dry matter).	Specific Gravity.	Quantity of Sugar in 100 parts of the Juice.	Quantity of non-Sugar in 100 parts of the Juice.	Quotient of Purity.
1	Oats	16	1783	912	19·70	1·082	17·00	2·70	86·28	15·60	1165	561	17.50	1·0722	14·42	3·08	82·40
2	Turnips	18	1926	917	19·70	1·082	17·20	2·50	87·31	16·10	1165	603	18·00	1·0742	15·02	2 98	83·44
3	Oats	9	1864	856	18·20	1·075	15·60	2·60	85·71	14 70	1165	603	18·00	1·0742	15·02	2·98	83·44
4	Oats	9	1692	943	17·40	1·072	14·50	2 90	83·33	13 60	1165	603	18·00	1·0742	15·02	2·98	83·44
5	Oats	6	1933	895	20·10	1·084	17·00	3·10	84·57	16·00	1165	603	18·00	1·0742	15·02	2·98	83·44
6	Potatoes	25	1792	1031	18·60	1·077	15·90	2·70	85·48	15·00	1165	603	18·00	1·0742	15·02	2·98	83·44
7	Peas	17	....	871	19·40	1·081	16·30	3·10	84·02	15·20	1151	629	18·80	1·0780	16·08	2 72	85·83
8	Sugar Beet....	20	1844	866	19·70	1·082	17·30	2·40	87·82	16·20	1151	629	18·80	1·0780	16·08	2·72	85·53
9	Sugar Beet....	20	1653	913	20·60	1·086	17·70	2·90	85·92	17·00	1151	629	18·80	1·0780	16·08	2·72	85·53
10	Sugar Beet....	21	1978	946	17·90	1·074	15·80	2·10	88·26	14·90	1151	629	18 80	1·0780	16·08	2·72	85·53
11	Marigolds	26	2975	1289	17·90	1·074	15·50	2·40	86·59	14·60	1151	629	18·80	1·0780	16·08	2·72	85·83
Total Average of English-grown Roots		16tons 18 cwt	1944	949	19·00	1·079	16·30	2·70	85·78	15·35	1159	611	18·30	1·076	15·45	2·85	84·42

MECHANICAL FILTRATION.

By Geo. Stade, Berlin—C 2.

Ever since the introduction of thorough clarification into the sugar industry, filtration by means of mechanical media has been found to be of the highest importance. When the raw juice was clarified at low temperatures, and the use of lime and sulphurous acid was very limited and unintelligent, filtration over charcoal was considered to be the only effective way of repairing the errors committed at the outset. In cane, as well as beet, factories, and last (and not least) in refineries, bone-black was used to a large extent. Sometimes over 100 tons* of char were used to 100 tons of sugar, and, of course, the expenses were found to be commensurate.

The progress made in clarification, and the absolute necessity, in face of declining prices, of reducing working expenses, soon pointed out the lines on which the improvements had to be directed. The effect of the charcoal on the juice—*i.e.*, decolorisation and absorption of salts—was found out to be attainable also by thorough clarification under regular chemical supervision and by simple mechanical filtration.

It is now a quarter of a century since Dr. G. F. Meyer, of Brunswick, practically demonstrated that first-class (beet) sugar could be produced without charcoal and with the greatest economy.

Since then all modern raw sugar factories have done away with bone-black, and even in modern refineries the use of it has very much been reduced or—circumstances permitting—has in many cases been abolished altogether.

Consequently the necessity of a thorough mechanical filtration has become of vital importance for successful working, firstly, as regards the quality of the sugar, and secondly, for the efficiency of the evaporating apparatus. The work of the mechanical filter is to cleanse the sugar solutions :—

(Firstly) in the raw or diluted state, to prevent certain chemical decompositions caused by the action of lime on some impurities, such as arabine, or to keep the suspended impurities from entering the clarifiers or the evaporators and thus to prevent incrustation.

(Secondly) to separate the impurities, particularly the lime salts, silicates, etc., which become suspended in the *semi-concentrated* stages

* *Vide* G. Stade, "On the Working of a Sugar Refinery."—*The Sugar Cane*, 1885, 13.

of the juice (between the first and last vessel of the evaporators), also in order to prevent incrustation.

(Thirdly) to eliminate the suspended portions of the *concentrated* juice, syrup or liquor, in order to improve the quality of the sugar, whether raw, granulated, or refined.

The mechanical filters more or less in use in sugar factories, chemical works, or for water clarification are very numerous, and quantities of patents have been taken out and often dropped again.

Without claiming to give a complete list, the constructions in practical use may be classed as follows :—

(A.) Those in which tissue of some kind or other is used. Among these may be mentioned :—

1. The old historical Taylor filter; working with long vertically arranged bags.
2. The Puvrez filter, in which the bags are placed horizontally in a gutter or trough.
3. The Pocket (and similar) filter; *e.g.*, those of the types Danèk, Kasalowsky, Scheibler, Excelsior, Claritas, Proksch, v. Ehrenstein, Muller, Philippe, Poulle, Bontemps and Rousseau, Feuillebois, Bride and Lachaume, Audonnet, and other systems.

(B.) Those in which other substances are used, with or without cloths.

1. Filter Presses working with xyloconchilith (Soxhlet's patent), charcoal dust, sawdust, kieselguhr, glass-wool, bagasse-dust, &c., &c.
2. Filters working with bagasse, gravel, cinders, china, glass, &c., according to the old charcoal system, the solution to be filtered entering either by the top or the bottom.

All these different systems possess, more or less, certain drawbacks and disadvantages which are often felt in practical working.

The filters of class (A), working with tissues, are only effective when the cloth is very tight. If taken too open the result is practically a negative one; if too close they are liable to choke very soon, and have to be cleared very often. Moreover, the loss in sugar is sometimes considerable, as a thorough washing out is not always advisable. If,

on the other hand the wash-water from the washing machine re-enters the factory, acidity is often the result, *and particularly in tropical climates* the filter cloth becomes a nidus for injurious bacteria; for instance, it is almost impossible to destroy the "Leuconostoc." Besides this, the filtering cloth is expensive, the wear and tear as a rule—even with washing machines—very great, and constant attention and much labour are required to keep the filters in order, in changing and washing the cloths, etc.

In regard to the filters of the second class (B) it is clear that of the filter-presses working with filtering media other than cloth, the existence of the same drawbacks may be assumed as certain. The filtering media such as xyloconchilith (a mixture of wood-pulp and kieselguhr) or charcoal dust, are also expensive as a rule.

The bagasse filters are liable to choking on account of the small filtering surface, the same may be said of the gravel filters working in the old charcoal style; every now and then the top layer of the gravel has to be stirred up to allow the filtering solution to reach the lower layers.

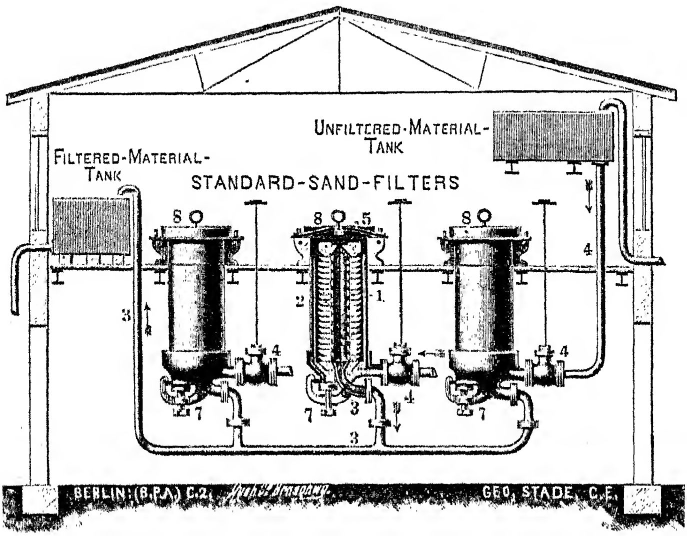
There can be no doubt, however, that the filtering qualities of sand are not surpassed by any other material as regards cheapness, facility of manipulation and regeneration. This is a fact well known and made use of—not only for sugar solutions but also to a far larger extent for water-filtration, etc.,—where, imitating nature, an extensive filtering surface is established, as in the case of large water works, giving the best results as to clearness, and also from a bacteriologico-hygienic point of view.

Of course, for clarifying feed-water or sugar solutions in factories the largest possible filtering surface ought, for practical reasons, to be given in the most compact form, and the facilities for filling, emptying, and cleaning, are weighty details to be taken into consideration.

The new sand filter described below has the merit of combining the largest possible filtering surface with the smallest requirement of space. The advantages claimed for it, of absolute cleanliness and facility in handling, are evident, and the sparkling brightness of the filtered solutions are not surpassed by any other system, not even charcoal. The effect is extraordinary, even with the most cloudy solutions, as can be confirmed by personal testimony, many of the Standard Filters being already at work in factories, refineries, etc.

This filter consists of a cylinder with conical bottom.

In the centre of this cylinder is fixed a perforated pipe (2) of large diameter, also with a conical bottom, communicating with the delivery pipe (3). Between this outside cylinder and the perforated pipe (2) a system of conical rings (1) is arranged in such a manner that one ring stands on the top of the other, the system being completed by a large ring at the bottom. The seats of these rings touch the outside cylinder but leave sufficient space for the filtering substance to circulate. Sand of a special grain is put between the perforated pipe (2) and the cylinder, where it forms a natural slope (*i.e.*, filtering surface) between the rings. The solution to be filtered enters the filter



through the pipe (4), fills the filter up to the air-cock (5), and passes (under the usual slight pressure) through the sand to the perforated pipe (2). The filtered solution issues by the delivery outlet (3). The sand has to be prepared before using, and the size of the grain varies according to the liquid to be filtered. For water and thin juice a smaller grain is required than for syrup or refinery liquor. Under any circumstances the perforation of the central pipe is regulated accordingly, to prevent the sand from passing through.

As soon as the sand is saturated with impurities, water is admitted through pipe (4), to expel the remainder of the solution which is being filtered, if necessary. The outlet (7) below is then opened while the water is entering, and the sand escapes at once. The filter is now

empty and clean again, ready for refilling. After washing the sand for *a few minutes with running water* or by means of an injector, the whole of the scum quickly separates and the sand is ready for again using in the wet state.

The Standard Sand Filters are in regular use this season for clearing raw-juice, cloudy liquors of the most gummy nature, concentrated syrups, and feed water.

For raw-juice, or for refining liquor containing coarse impurities, two filters are recommended; the first filter is filled with coarse sand taking up solid impurities in order to relieve the second filter.

The deposit of the scum in the Standard Filter is found—not only on the external surface—but also throughout the *whole section* of the sand, as can be easily verified when a filter is opened for discharging. Of course the outside layers—where the sand forms a slope on the rings—contain a greater amount of deposits than the layers near the perforated pipe. The whole of the intermediate space between the sand-grains is utilised for the storage of scum. The action and reaction (due to the force of attraction) between the deposit and the sand-grains takes place through the whole layer of sand. This is the cause of the high efficiency of the Standard Sand Filter. One filter for concentrated juice, working with sand of 0·6 to 0·8 mm. diameter, is amply sufficient for working 200 tons of raw material and runs from three to eight days, replacing for the same time three ordinary pocket filters. For refineries working with charcoal filtration it has been found that a Standard Filter arranged in front of the char filter *saves 30 per cent. of charcoal*, by preventing the pores of the char from being choked with mechanically suspended matter.

It is only a short time since these filters were invented, and already hundreds of them are at work. The simplicity in construction, small wear and tear, efficiency in working, the doing away with any expensive filtering media such as cloths, etc.; the facility of manipulation and the quickness with which the sand is regenerated, combined with the limited requirements of space, indicate that the Standard Sand Filters are likely to be appreciated by all sugar manufacturers and by many others, particularly as their price is very moderate. A Standard Filter of two metres high and 0·8 metre in diameter, doing as much work as three pocket filters, costs f.o.b., only £120, inclusive of the patent royalty, and they can be obtained through the agency of the undersigned.*

GEO. STADE.

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* See advertisement page x.

THE USE OF BONE-BLACK, CHAR, OR ANIMAL CHARCOAL.

A short time ago a somewhat lively discussion, lasting over several weeks, took place on the above subject, in the columns of the *Journal des Fabricants de Sucre*. It appears that at a meeting of the "Société technique et chimique de sucrerie de Belgique," in consequence of a statement made by the eminent French sugar chemist, M. Aulard—to the effect that whereas he had not been able to realise any increase of purity from the use of the ozone process of clarification, he had, in the Marseilles refinery, succeeded in raising the purity of the syrups by three degrees, M. Sachs, secretary of the Society, after some questions as to the actual degree of purity of the syrups, made the following remark: "I would merely wish to point out how "surprising it is to meet with a noticeable increase of purity resulting "from the use of bone-black when its use has been everywhere given "up, even in such refineries as the one under the direction of M. E. "O. v. Lippmann, at Halle." M. Aulard not having replied to this remark, M. Weisberg took up the cudgels for him in a letter addressed to the *Journal des Fabricants de Sucre*, and expressed his surprise that allusion should have been made to the Halle refinery, in which the Soxhlet process, which avoids the use of bone-black, was no doubt found quite sufficient for the production of the degree of purity required by their customers, while if M. v. Lippmann wanted to obtain sugars of a high degree of purity such as the first French (Say) or Russian marks, he would be compelled to have resource to the time-honoured bone-black so disdainfully criticised by M. Sachs. Further, while in Russia the *majority* of the factories still continue to filter their syrups over bone-black, the practice has not been completely abandoned in Germany and Austria. M. Weisberg fully corroborated the statements of M. Aulard, and said that he himself had obtained even better results than those named, adducing authentic figures in proof which justified the assertion "that bone-black still remains one "of the best agents for raising the purity and improving the saline "and organic quotients of both factory and refinery syrups, not to "speak of the decolorisation, to a greater or less degree, after filtration, "the degree of improvement being naturally dependent on the quality "and quantity of char employed." The further rejoinders and counter-statements of these two gentlemen attracted the attention of "an old sugar manufacturer," who confirmed the statement of M. Sachs, that the abandonment of bone-black filtration was largely owing to its

being improperly used, and consequently becoming an injurious instead of purifying agent, because it was allowed to become dirty. He added that people were still engaged in endeavouring to discover the best practical means of clarifying, but none of the new processes had yet been able to supplant the bone-black which, even if used in only small quantity, will give better work and a higher yield, diminish the proportion of "undetermined" in the sugars, and improve the quality of the lower products. Now that syrups were being re-introduced into the working, he considered there was every reason for purifying them previously to their being employed.

M. Sachs naturally took exception to these statements, and asserted that a large portion of the results predicated in favour of the use of bone-black was based on laboratory experiments, and that practically no noteworthy increase of purity had been obtained in the factories; but as regarded the refineries, a large number of these, in Belgium and in France, still thought they could not do without bone-black. M. Sachs declared that he did not consider himself competent to decide, and he did not think M. Weisberg was any more so, and therefore he would not discuss the question with him, but leave it to specialists. He then gave in full a letter from Dr. E. O. von Lippmann, who is universally recognised as a high authority. This letter stated that, theoretically, good results could undoubtedly be obtained with bone-black, but one must be prepared to ignore the expense and losses attending its use, and also to take measures for preventing the re-introduction into the working of the non-sugars absorbed by the charcoal. His own experience, and that of Dr. Stammer, did not go to prove that the increased purity, even with the best filtration over new bone-black, resulted in a higher degree of crystallisation, *i.e.*, in a better yield. And the question was after all one of economy, viz., whether the bone-black process paid better. The price obtainable in Germany did not allow them to go to any great expense, and it was a fact that there were in that country a large number of refineries producing loaves, cubes, granulated, and even candy sugar without the use of bone-black, and they were able to compete with refineries which used the expensive bone-black filtration.

The *Journal des Fabricants de Sucre* gave an extract from a letter received from a very competent correspondent, of which the following is a translation:—

"If bone-black no longer plays anything but an insignificant part "in other countries, it is not so in France. The large Paris refineries

"still employ large quantities of black, and are very careful in the "re-vivification of that agent. And so they obtain a magnificent "quality of sugar. From the point of view of quality, the French "sugars fear no competition, and will always be in demand by a "certain class of customers. None of the existing processes, not even "that of Soxhlet, of which so much has been said, can furnish products "comparable with those of the French refiners who use bone-black "carefully prepared and employed on a large scale."

The further discussion of the matter between M. Sachs and M. Weisberg was rather on personal matters, than on points throwing any clear light on the question of the use of bone-black, but the following communication from another correspondent of the *Journal des Fabricants de Sucre*, who seems to speak with authority, is not without value as summing up concisely, and yet with a reasonable amount of detail, the views in regard to bone-black which he considers to be now generally held as the result of past experience, for which reason we give a full translation.

"It has long been known that bone-black has a perceptible action on the juice and the various products of a sugar factory. This action is very complex, but it is not my intention to reproduce or even to summarise all that has been done in the matter since this agent was brought into sugar manufacture. I will simply remark that the properties of bone-black may be summoned up as follows :—

1. Absorption of colouring matters.
2. Absorption of alkaline lime and of certain salts of lime.
3. Absorption of certain organic matters.

The absorption varies with the quality of the bone-black, the degree of fineness, the duration of its action, the temperature, the concentration of the liquids, &c.

Consequently it is perfectly well-known that, if bone-black is employed in sugar manufacture, the masse-cuites obtained are lighter coloured and contain a smaller quantity of salts of lime, and a somewhat lower proportion of certain organic matters, resulting in a better quotient of saline substances and an increase in purity. These results have been known for many years; they have been published by numerous chemists, both in France and elsewhere, and confirmed by the figures published in a former number of the *Journal des Fabricants de Sucre*. But it is also already known in the sugar industry that juices can be obtained exempt, or nearly so, from salts of lime, which considerably reduces the utility of char from that point of

view. It has also been generally noticed that the effect of bone-black on the organic substances diminishes with the proportion of the lime salts, *i.e.*, that its effect on the purity of the juice becomes feeble when the juices are free from lime salts. Now on the other hand, the decolorisation of the juice can be effected by means of sulphurous acid, applied either at the outset, or to the syrup, or to the masse-cuites, and hence light coloured masse-cuites can be obtained without using bone-black. This has been confirmed in practice, and in a large number of factories the masse-cuites resulting from working with sulphurous acid are lighter coloured than those obtained by working with bone-black. But the results obtained by experimenting in the laboratory with regard to the action of bone-back are far from being the same as those ascertained in practical working. Undoubtedly, if we take into account only the product at the commencement of filtration, we mostly find that it has been improved by the bone-black. But the effect of this sensibly diminishes in proportion as the filtration proceeds, so that the average is considerably below that ascertained by an examination of the juice at the beginning of the operation. This is not all. The char has absorbed some of the sugar, the filter has become filled with juice, and it must be washed in order to avoid loss of the principal product. Now this washing brings back into the working a portion of the matters absorbed. It has been said that the sweet water preceding from the washing of the bone-black might be utilised for diluting the dry lime and in the scum washing. There is already plenty of water. Finally, it must be noted that the char gradually loses its properties with repeated revivification.

Hence, taking into account the expenditure corresponding with the loss of bone-black, the cost of revivification, the sugar absorbed notwithstanding the washing, the general dilution of the juices which have to be evaporated, &c., it has been calculated that the manufacturer gets no benefit by using bone-black, but, on the contrary, would gain by doing without it. This is the practical result, all the more so because by abandoning it, he is forced to modify the apparatus for mechanical filtration of juice and syrups, while the charcoal filters were used to filter all sorts of juice more or less clarified by settlement. Further, as he could resort to sulphurous acid, the manufacturer could produce masse-cuites as pure, and often even better decolorised, by working without bone-black than with it, after having properly treated the juice by the ordinary processes of double carbonatation.

The quantity of bone-black generally used was from 3 to 5 per cent. of the weight of the beets.

In view of the inadequate results obtained in practice as regarded the improvement of the quality of the juice, the use of 8, 10, or 15 per cent. of bone-black has been recommended. Scientifically this was correct, practically it was not so, because the increased expenditure was not compensated by the effect produced.

I would here remark that I am only speaking of the use of granular bone-black in sugar manufacture. The action of pulverised bone-black is more rapid and more effective, but it must be employed under different conditions. The advantages and inconveniences of its use can be easily estimated.

To sum up, as regards sugar manufacture from a scientific point of view, it has been long known; (1) that granular bone-black is capable, in certain cases, of improving the quality of juices and syrups, both as regards colour and general purity; (2) that the expenditure attending its use is not compensated by the total effect produced; (3) that its abandonment, on the contrary is a gain to the manufacturer, who (4) has at his disposal processes of filtration which will enable him to obtain juices and syrups as clear and limpid as those from filtration over bone-black; (5) that he also has at disposal various methods of decolorising juices and syrups, if he requires them to produce the desired quality of sugar; (6) that any manufacturer of sugar using bone-black under proper conditions will always obtain results, in regard to decolorisation and general improvement in quality, which will increase with the quantity of char employed; it is for him to see whether the financial results are satisfactory.

What I have above stated is well known to all who have been seriously and for a lengthened period engaged, both theoretically and practically, in the manufacture of sugar. I am therefore surprised to see the question made the subject of fresh discussion, such as would always excite a certain amount of interest if new facts were adduced, which, however, appears not to be the case in the present instance."

According to the *Chemiker Zeitung*, a new sweetening substance, called *sugarine*, the chemical name of which is "Methylbenzol-sulphinide," and which is closely related to *saccharine* (benzolsulphinide) is being offered for sale, and it is declared to be 500 times sweeter than true sugar.

STEIN'S NEW PROCESS OF SUGAR REFINING (WITHOUT ANIMAL CHARCOAL).

We have been favoured with particulars regarding this new process of sugar refining, patented by our esteemed contributor, the well known sugar expert, Mr. Sigmund Stein, of Liverpool.

This process consists in the judicious decomposing of the non-sugars (both inorganic and organic) and the colouring and gummy matters contained in raw sugars. This object is attained by the proper use of certain chemicals in the primary stages of refining. We are not at liberty to specify in detail the agents which are used in this process, but may state that they are very cheap and easily manufactured, and their application to any particular kind of sugar presents no special difficulties.

The mechanical appliances are of a very simple character, and practically of no great cost, and a whole refinery can be worked entirely without animal charcoal, simply by this process and with the use of proper chemicals.

The process can be applied in raw sugar works for manufacturing refined sugar direct, or in refineries for refining either cane, beetroot, or maple sugar. The processes of manufacture or refining are expedited and improved, and the individual operations more effectively and efficiently performed, while the quality and quantity of the products are also improved.

This invention consists in certain special treatment of the sugar and liquors at different stages of manufacture and in the employment of certain substances and chemicals, and relates to the treatment of raw sugar or liquors, and also the refining of sugar and sugar liquors, the effect and result being that perfectly white, clear, and bright crystals are produced by a single and inexpensive method, without the use of any charcoal whatever.

In this process there is no necessity for after-products, as all the syrups resulting from this method of manufacture can be again purified and brought back into the original working, the final products being only first grade sugar and molasses.

The molasses ultimately turned out are sold or used for distilling, or worked up by one of the known molasses-extraction processes, or used for feeding purposes. Cane sugar molasses or cane sugar refinery molasses are worked up for Golden Syrup.

The Golden Syrup ultimately resulting from this process is of a bright colour, good flavour, and is appreciated for table use.

A new refinery for working by this new process can be erected very cheaply, on account of many machines being eliminated. An old refinery could also be adapted for this process without any great expenditure of capital.

The inventor, Mr. Sigmund Stein, intends to appoint in every country agencies for this process, and will give preference to engineering works and engineers and to technical and practical sugar chemists. In each country, the factory which first adopts this process will be treated on specially favourable terms. As regards the expense of the process, we are informed that the total cost of treatment does not exceed $1\frac{3}{4}$d. per cwt. of refined sugar, and there is, moreover, a great saving in charcoal, coal, labour, machinery, interest on capital, depreciation of plant, etc.

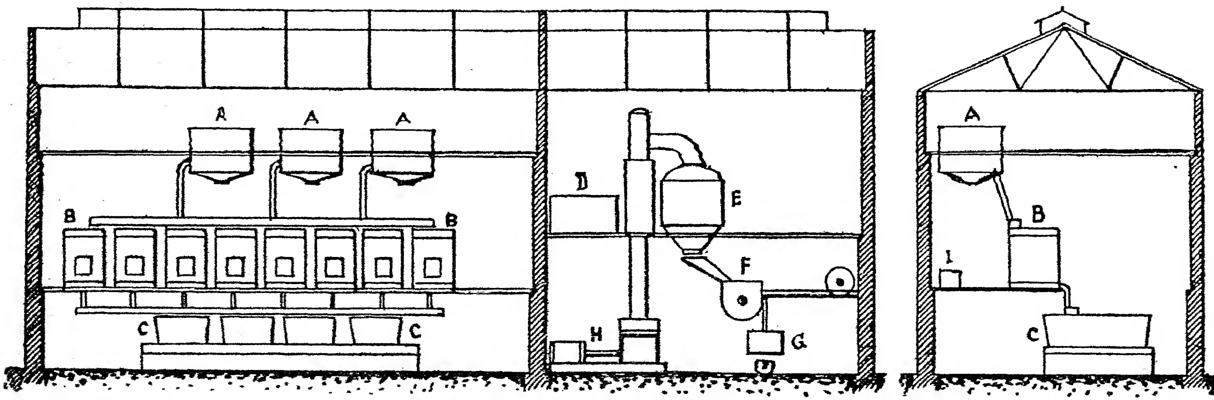
By this process the best white crystals, cubes, loaves, and granulated can be produced without the use of animal charcoal, and very bright and fine coloured cassonades (after-products) can be made.

This process will be of special importance in using very low grade sugars, specially cane sugars, as for instance: Brazil, Ilo-Ilo, Taals, Manilla, Jaggery, Java Stroops, Mauritius syrups, open-kettle and native sugars, second runnings and after-products, and will be particularly welcome and applicable in countries where the use of animal charcoal is precluded owing to religious objections.

To give some idea of the cost of plant, we may state that the inventor informs us that the outlay for the mechanical portion of a refinery working up 300 tons of Jaggery per week would be about £6,000.

Applications for Licenses should be addressed to the Inventor, Mr. Sigmund Stein, 323, Vauxhall Road, Liverpool (England).

Arrangement of a Sugar Refinery for working Stein's Process of Refining without Animal Charcoal.



A. Melters. B. Bag Filters. C. Receivers. D. Vacuum Pan Supply Tank. E. Vacuum Pan.
F. Mixers. G. Centrifugal. H. Vacuum Pumps. I. Bag Washing Tank.

ON RECENT ATTEMPTS TO DO AWAY WITH THE AFTER PRODUCTS.

By Rudolf Hafner.

(Completed from page 610.)

(3.) *The Berggreen Process.*

D.R.P. No. 96,677, December, 1896; additional Patent No. 98,682, February 2nd, 1897.

The specification of the principal patent is as follows:—

Method for the separation of crystals from the syrups from sugar manufacture, which consists in subjecting for a long time the massecuite, supersaturated by suitable concentration but without the addition of crystals, to a temperature of at least 85°C., so as to avoid the viscosity which prevents the formation of suitable crystals, whilst at the same time the crystallising liquid is either intermittently or continually thoroughly stirred.

The additional patent runs:—

In the process protected by the chief Patent No. 96,677, the addition of lime or any other basic body to the crystallising liquid, which addition produces, in conjunction with the high temperature maintained for a long time, a decomposition of the organic non-sugars and decreases the viscosity of the concentrated liquid.

In the *Deutsche Zuckerindustrie* for 1898, page 586, there is the following report on this process, as carried on at Roitzsch:—

"The green syrups are evaporated in vacuo to from 93 to 93·5% of dry substance and then run off into a specially constructed crystalliser.

"The crystallisation is effected at about 75°R. so as to keep the mass quite thin by superheating, and to counteract the viscosity so disadvantageous to crystallisation. In consequence of the high supersaturation of the syrups, crystals begin to form, notwithstanding the high temperature of 75°R., in the course of an hour. To complete the separation of crystals from the crystallising liquid and to prevent the formation of too fine crystals (false grain) the malaxeurs are provided with a heating and a cooling arrangement, which, in consequence of the motion of the apparatus during the operation, produce repeated variations of temperature. During the cooling, fresh portions of the sugar dissolved in the liquid are constantly induced to separate and deposit themselves in solid form upon the already formed

crystals, whilst the "false grain" produced at the same time is dissolved by the subsequent heating. In this manner the crystals are fully formed in the very highly concentrated masse-cuite which is heated for 36 to 38 hours at a temperature of about 75°R., with simultaneous application of the cooling arrangement; the masse-cuite then needs only to be cooled to the required temperature for centrifugalling. In this process a peculiar action of lime on the syrups has been at the same time utilised. Practical experience teaches us that by combined action of lime upon the non-sugars the quotient of the sugar solutions can be essentially improved. This action of lime has been further intensified at Roitzsch by the lime being allowed to react a considerable time, viz., about 36 hours, at the high temperature of 75°R. upon the concentrated green syrups in the crystallising apparatus. Numerous parallel experiments showed the remarkable fact that the masse treated with lime always gave a higher yield and better sugar than one not so treated. This fact, however, requires further explanation; the extraordinarily great evolution of ammonia in the centrifugalling of the masse-cuite treated with lime can only be attributed to the decomposition of amido-compounds. At Roitzsch the first product masse-cuite yielded up to 83 per cent. of first sugar. The II. product masse-cuite treated according to the above described crystallising process gave up to 39 per cent. sugar of second sugar. The III. product was allowed to crystallise in ordinary tanks and yielded after centrifugalling only about 1·5 per cent. of molasses with a quotient of from 57 to 58."

(4.) *Dr. H. Classen's Process.*

D.R.P. No. 89/89784, January 21st, 1895.

Specification:—

1. Method for improving the boiling of sugar juices and syrups, which consists in introducing dry or slightly superheated steam, of higher pressure than that in the evaporating vessel, through perforated or slit spiral tubes or similar distributing arrangements, into the lower part of the boiling apparatus, which is heated in the usual way, for the purpose of keeping the mass in uniform motion and maintaining a constant regular boiling.

2. In the above process, the application of vapour from the first pan of the evaporating apparatus or of vapour from the ammonia outlet pipes.

This describes the whole process.

(b) By addition of already formed crystals.

Instead of allowing the crystals to form themselves, Wulff introduces crystals into his crystallisers, by which means already existing crystals are enlarged and attain a considerable size. Instead, however, of constantly stirring up the crystals in the various crystallising vessels and allowing them to fall through the layers of syrup, Wulff proceeds in the opposite direction ; he allows the crystals to remain undisturbed and passes the syrup through them. This latter proceeding is embraced in the last five points of his Austrian Patent No. 37,978 and is known as the sub-induction method. Probably this method has not been adopted in ordinary sugar manufacture, but rather in the manufacture of candy, for producing large crystals. This method is applicable in all industries producing crystallised products such as borax and the like.

I would recommend everyone to read the very interesting Austrian Patent No. 37,978 above mentioned, in which crystallisation in movement and the method of sub-induction are discussed in detail.

(c) By artificially produced formation of grain in conjunction with crystallisation in movement.

The advantages and disadvantages of the methods of working up the green syrups already described finally led the industry to the newest processes, which will be discussed in the remainder of this paper.

Let us once more consider crystallisation at rest and crystallisation in movement. From what has been said before, it will be seen that the quantity of crystals formed in consequence of the cooling of the evaporated masse-cuite is dependent upon many circumstances, such as the concentration and temperature of the syrup masse-cuites, their chemical properties, the temperature of the chamber, etc. In consequence of this, the production of the quantity of the crystals cannot be accurately regulated. In the newest methods free crystallisation is entirely avoided. The formation of crystals and their quantity are artificially controlled, and these crystals are caused to grow by means of crystallisation in movement. These new modes of working give in the shortest time the maximum yield of sugar which has hitherto been obtained. Many processes have recently been devised, of which I may mention the following: Abraham, Grossé, Freitag, Fuchs, Maranc, and Sachs. In the case of all these processes, however, when they are carried out in detail and considering the high royalty, the plant is somewhat expensive, for in many

instances it is not only a question of the installation of the process, but total reconstruction and extension of the centrifugalling station, purchase of new steam-engines, etc., are frequently involved; and commercial considerations prevent many factories, especially older and smaller ones, from adopting one or other of the processes.

The essence of them all consists in the following principles:—

1. Artificially produced formation of grain.

2. Growth of the crystals; firstly by evaporating and then subsequent cooling.

It is from these points of view that the processes and apparatus have been devised. I would recommend for perusal the following article: "Moderne Methoden zur Verarbeitung der Nachproducte," by Otto Mittelstaedt, in Amsterdam (Oesterr. Zeitschrift, 1898, Vol. V., page 665, and D.Z.I., 1898, Vol. XXIV., page 850).

(1.) The Abraham Process.

This method is not very popular with us, and I do not know whether any factory in Austria-Hungary ever has worked or does now work according to this process. I therefore simply refer you to the patent specification and the articles respecting the method published in our special journals.

(2.) The Grossé Process.

Description of the apparatus: The Grossé vacuum is a stationary, cylindrical, coil vacuum pan with a conical single bottom. A vertical circulation pipe of 600 mm. diameter is fixed in the vacuum, in which there is a coil with seven turns, which, with 15 revolutions to the minute, carries the masse-cuite from the bottom to the top. A "catcher" is fixed on this conducting pipe for the purpose of distributing the masse-cuite as it falls down from the circulation pipe. The working of the agitator is effected from above by means of cog-wheels.

The heating coils can be heated with high or low pressure steam according to the temperature required. As the Grossé process is carried on at low temperatures, the heating surfaces of these apparatus are correspondingly small. For apparatus with a capacity of up to 200 metr. ctr. of masse-cuite, 10 square metres of heating surface are sufficient. For 350 metr, ctr. of masse-cuite, 22 square metres of heating surface are required. The mode of working is as follows:—

The apparatus is at first filled only to one-third with the syrup to be worked, and evaporated to string proof. The introduction of fresh syrup is now commenced. The first three additions must be very

small, so as to form large quantities of very small crystals, the best syrups are used, if necessary, for these three additions. The masse will probably be filled with grain after the third addition, and larger quantities are now run in. When making the additions care has to be taken that the syrups have the same temperature as the masse in the apparatus, thus preventing a new formation of crystals. During this time the apparatus requires very little care, the masse is concentrated very slowly, as only a small quantity of water becomes evaporated. Not until the apparatus is boiled down to at least three-fourths full is the agitator started. The evaporation goes on quietly, further additions being made until the masse in the apparatus covers the feeding pipe. Up to this stage the boiling is known as the "filling period;" the "exhausting period" now commences, when the temperature is allowed to decrease slowly until it finally falls to 55°C. During this period it is essential to keep the difference of temperature between top and bottom layers of masse-cuite in the vacuum as great as possible. The masse is, according to its quality, evaporated down to from 8 to 6 per cent. of water; the steam is then shut off, the agitator, however, continuing to work.

The boiling out proceeds as slowly as possible; it is best to allow it to continue for 36 hours and to keep the masse as cool as possible, but during the formation of crystals the temperature in the vacuum should be higher. After the masse-cuite has been stirred for from 20 to 30 hours in the apparatus, crystallisation may be regarded as finished. A small quantity is taken out, and the sample centrifugalled in an experimental centrifugal machine.

If the syrup running off should still have a high quotient, the stirring, or the boiling down, is continued; if the sample shows complete crystallisation, the whole boiling is emptied into an open mash-pan and at once centrifugalled.

The following are considered to be the advantageous points of this process:—

From the green syrup of the first product with a quotient of between 78 and 68 are obtained, in the course of 50, 60 or 70 hours, an excellent sugar and molasses with a quotient of up to 58, which on further evaporation will no longer crystallise. Rapid working, high yields, production of the whole of the obtainable sugar in one operation, economy of labour, of interest of money, avoidance of mechanical loss and of subsequent operations, are given as concomitant advantages.

On January 14th, 1899, I witnessed the working of the Grossé process in the Elsnigk factory, near Köthen. The masse was very fine, completely filled with grain, and could be easily centrifugalled. The sugar obtained was somewhat sticky and rather difficult to discharge by the outlet.

The yield from the masse-cuite could not be given, because at Elsnigk there is no means of weighing the masse-cuite. The sugar is sold just as it is, in spite of its low rendement (as a rule under 80), and is not put back into the juice workings. The following yields were obtained at Elsnigk by the Grossé process:—

Of 100 parts of sugar in the beets:—

	Chemically Pure Sugar. Per Cent.
In raw sugar, I. product	79·00
In raw sugar, II. product	8·90
In these two sugar products	87·90
In the molasses	5·91
Total saleable products..	93·81
The resulting loss being	6·19

With regard to the cost of construction, Herr Hugo Jelinek, the representative of Grossé for Austria, gave me the following data.

For the daily working-up of 5,000 metr. ctr. of beets, it is necessary to have:—

	Florins.
2 Grossé-Apparatus holding 300 metr. ctr. masse-cuite	12,000
1 Refrigerator	2,500
Cost of erection, about	3,000
Total outlay	17,500

For a daily working-up of 7 to 8,000 metr. ctr. of beets:—

	Florins.
3 Grossé-Apparatus holding 300 metr. ctr. masse-cuite	18,000
1 Refrigerator	3,000
Cost of erection	3,000
Total outlay	24,000

For a daily working-up of 10,000 metr. ctr. of beets:—

	Florins.
3 Grossé-Apparatus holding 400 metr. ctr. of masse-cuite	20,000
1 Refrigerator	3,500
Cost of erection	3,500
Total	27,000

If it is possible to obtain everywhere such yields as at Elsnigk, the entire working of the II. or III. product and osmosis of the I. product would be done away with, and the plant would pay for itself within four to five years out of the saving, provided that on the introduction of this method no other further additional plant is necessary. The plant and the working at Elsnigk are very simple and neat, and create a favourable impression.

The following factories are working according to this method:—In Germany, Elsnigk and Opalenitza; in Russia, Alexeyewka and Schebekino; in France, Vénizel.

SUGAR AS MEDICINE.

(J. Blossveld, in the *Deutsche Zuckerindustrie.*)

A good deal has been written of late respecting the action of sugar in the human and animal organisation, and we now know that it increases the muscular force and is a valuable article of nutrition. Its effect, from the general hygienic point of view, has been less fully illustrated. It will therefore not be uninteresting for me to state what the old Professor of Hygiene, Dr. Chr. Wilh. Hufeland, says in his book, "Makrobiotik, or the Art of Prolonging Human Life" (Berlin: Verlag von Georg Reimer, 1853), in regard to the consumption of sugar. Dr. Hufeland is a well-known hygienist, highly esteemed also for his skill in diagnosis. Speaking of the means of prolonging life, he says:—"Sugar is one of the best means of reducing the temperature of the system. For overheating of the body there is nothing better than to take an ounce dissolved in a glass of water, also in fever and diseases accompanied by high temperature, in catarrh, and especially also after excitement due to fright, vexation, or anger, in which it has the further good property of soothing and emptying the irritated gall-bladder. Added to things that are heating it diminishes that property; thus coffee taken with plenty of sugar

is less heating than when taken without. Sugar dissolves phlegm. It is mere prejudice to say that it produces mucus; it can only do this by too frequent and long continued use, in which case it may induce weakness of the stomach. But its immediate action is solvent, hence in catarrh of the stomach and other catarrhs, roughness of the throat, cough with deficient expectoration, there is no more wholesome drink than the solution of sugar already prescribed. Sugar cleanses the stomach and the intestinal canal, and, taken in large quantity, has a purgative effect. It is of service in all cases of overloading and foulness of the stomach. After a too heavy meal I have frequently seen all uneasiness disappear on taking one ounce of sugar dissolved in water. It acts as a first-class digestive. It also furthers digestion by its stimulative power. You can salt your food just as well with sugar as with ordinary salt, and so increase its digestibility."

The value of sugar in the case of children may be learned any day. For instance, where a child has at night a hard cough, passing into a sort of hoarse bark, causing the parents to fear an attack of croup, a teaspoonful of powdered sugar, taken dry, will often have an excellent effect. Naturally, as everything eaten in excess is injurious, so it is with sugar. After too large a consumption of sugar there finally ensue fermentation and acidity of the child's stomach, and even diarrhœa and vomiting. But there are never any evil after-effects; on the contrary, such "explosions" are followed by an actual gain in health and an unusual sound state of the system. Indisposition in children after eating cakes, especially just about holiday times, is to be ascribed far less to the sugar than to the too large quantity of greasy substances, and to the other too rich foods then consumed. On the contrary, the sugar has a regulating action. Proof can easily be obtained. Let anyone offer a child, just after it has got over such an indisposition, ordinary cakes, not so rich in fatty substances, and it will eat them at once and ask for more, if the stomach has been properly cleaned. Unfortunately, children are, as a rule, given pastry too greasy, and too much thickened with eggs.

[The above remarks are recommended by the *Deutsche Zuckerindustrie* to be widely circulated, and we quite agree that the healthy and wonderfully beneficial effect of sugar, both as medicine and as an article of diet, cannot be too well known, especially in face of the stupid prejudice which formerly existed as to sugar being a cause of biliousness, in a day, be it remembered, when the consumption of

inordinate quantities of alcohol in one form or another—many of them unsound and impure—was the rule, and moderation the exception. The unquestionable digestive action of such liqueurs as noyau, chartreuse, bénédictine, curaçoa, &c., taken after food, is largely owing to the great quantity of pure sugar they contain.]

HOME GROWN SUGAR.

Experiment in growing Sugar Beet Roots at Newnham Paddox.

In these times of agricultural depression, any attempt to find a paying crop must be commended, and it will be instructive to read the following account of the experiment carried out at Newnham Paddox by the Earl of Denbigh. Mr. Sigmund Stein, of Liverpool, has devoted much time and attention to this subject, and it was under his advice and assistance that the experiments at Newnham Paddox were carried out.

The seed selected was the Metto Vilmorin. It was sown on well prepared ground, that had been deeply trenched in the previous year, in rows fifteen inches apart, and the plants were afterwards thinned out to six inches apart. Before the seed was sown, the land was dressed with fresh lime at the rate of eight tons to the acre, and afterwards dissolved bones at the rate of eight cwt. an acre were applied. The seed was sown on the 13th of May, 1899, the ground was constantly hoed, not because there were any weeds, but to promote the growth of the plants, and after the first hoeing a dressing of dissolved bones, at the rate of four cwt. an acre, and nitrate of soda, at the rate of two cwt. per acre, was given, and later on the same amount of manure was spread round the plants, and care was taken to always hoe the ground immediately after each dressing of manure.

No farmyard manure was used, and this is not recommended, but the land had been well manured for the crop of potatoes taken in the previous year.

The roots were taken up on the 24th of October, and a portion carefully weighed, and it was found that the roots, with the leaves attached, weighed at the rate of 42½ tons per acre, while, after the leaves were removed, the weight of the roots was 25 tons, 12 cwt., 3 qrs., 12 lbs. an acre.

The analysis of the roots grown at Newnham Paddox, compared with that of roots grown at Magdeburg, in Germany, was made on the 11th October by Mr. Sigmund Stein, of Liverpool, and will be found under reference No. 6, in the tables appended to his General Report for the current year on Beet Growing Experiments in England, published in the present number.

Mr. Stein remarks:—

"These well shaped roots are satisfactory in every respect. Saccharine contents, quotient of purity, and weight considerably exceed the German figures. I consider them excellent for manufacturing purposes.

"SIGMUND STEIN.

"October 11th, 1899."

In explanation of this report and analysis, it may be stated that the value of the roots, for the manufacturing of sugar, depends upon the quotient of purity and the percentage of sugar. The quotient of purity may vary between 80 and 90. Anything under 80 would be very low, but 91 must be considered exceptional. The percentage of sugar may vary between 10 and 19; 10 per cent. would be very small, and 20 per cent. very high.

To show the value of the roots for manufacturing sugar:—With a quotient of purity of 70, and 10 per cent. of sugar in the roots, the value of the roots would be only 11s. 11d. a ton, but with a quotient of purity of 95, and 16 per cent. of sugar in the roots, the value would be 25s. 8d. a ton. These figures are founded on data given by the late Dr. Carl Stammer, one of the chief beetroot sugar experts in Germany.

On the same data, the value of the roots grown at Newnham Paddox would be 23s. 1d. per ton, and with 25 tons to the acre, the gross value of the roots would be £28 17s. 1d. per acre, not a bad return in these times of agricultural depression.

The proportion of leaves to the roots in the sugar beet grown at Newnham was very large, and no doubt the manures used were rather too forcing, as, with 25 tons of roots, the leaves ought not to have exceeded eight or at most ten tons.

The great difficulty in the successful growing of sugar beet is the question of sugar factories. The cost of a factory to make sugar on a profitable scale would be about £50,000, and it would require 40,000 tons of roots a year, and this would mean quite 2,000 acres of sugar

beets, but, assuming the roots could be grown, the result to the manufacturer would be satisfactory, as, with sugar at £9 a ton, the profit (according to S. Stein, "Sugar," 2nd edition, 1898) would be 6 per cent., and with a price of £10 a ton, 14¾ per cent., of £11, 23·4 per cent., and of £12, 32 per cent., so it is pretty certain that if a sufficient supply could be guaranteed, there would be found men with capital who would take any amount of roots.

A FRENCHMAN'S OPINION OF THE FRENCH SUGAR BOUNTIES.

The subjoined very expressive letter from M. Yves Guyot, who held the portfolios of "travaux-publics" under the Governments of MM. Tirard and Freycinet from 1889 to 1892, forms an appropriate sequel to the translations and summary given in our November number, pp. 568-570. The letter was read at a dinner at the National Liberal Club, October 18th, and is addressed to Mr. J. H. Levy, Honorary Secretary of the Political and Economic Circle of the Club, and contains, among other things, a concise summary of the French legislation as regards sugar for the last fifteen years:—

Paris, October 10th, 1899.

My Dear Friend,

Various circumstances prevent my being present at your dinner which is to take place on the 18th inst. under the presidency of Sir Nevile Lubbock. I am sorry for this, as I should have been very glad to hear a communication from such a competent man as Mr. Mayson M. Beeton on the question of bounties and countervailing duties, and to take part in the subsequent discussion. Will you allow me to state some of the considerations which I should have laid before you if I had been present on the occasion?

I.

You might have supposed that, as a Frenchman, I should tell you that from an economical point of view I disapprove of premiums on exports, but should ask you not to levy countervailing duties on imports; and in support of this thesis I should certainly have been able to appeal to Free Trade arguments which—as I know from the private discussions which we have had—you do not admit, but which I hold to be good.

Such a supposition would, however, have been incorrect. So far from persuading the English not to impose countervailing duties on sugar, I would tell them that if by such means they should bring about the abolition of the bounties which we are at present giving on sugar, they will have rendered a most signal service to France, to the French taxpayers, and, I would add, even to the French sugar manufacturers; and I could say it with authority in the name of all the men, women, and children, to whom it is both a desire and a necessity to consume sugar and coffee, in the name of all the manufacturers of preserves, chocolate, and biscuits. As the name indicates, the bounties on production are intended to stimulate production. Produce! Produce sugar! You will be paid for producing!

And why are they to produce? For amusement? The industry has no *raison d'être* unless it produces in order to sell. But that is not the question. Produce—we will pay you for producing—and in order to pay you we will levy on the sugar, the production of which we are encouraging, such high taxes that for a large number of consumers they will be prohibitive! Produce! The Treasury will pay you, but in order to pay you it will deprive you of the consumer who would ask nothing better than to pay you direct in exchange for your product. It will take the product out of his mouth to pay you for manufacturing it. And the result is, that *while the consumption of sugar has increased in all countries in very considerable proportions, it has remained almost stationary in France.*

CONSUMPTION OF SUGAR IN METRIC TONS.

	1884-85	1897-98
Austria	188,400	366,900
France	425,200	459,300
Germany	375,700	708,200
Holland	44,900	73,000
United Kingdom	1,204,800	1,655,500
United States	1,254,100	2,047,300

Does the Frenchman not want to consume sugar? He has proved that he asks nothing better than to increase his consumption. When the tax was reduced in 1880 from fr. 73·32 to fr. 40, the consumption rose from 322,200 kilos. to 376,400 in 1881, 408,200 in 1882, 403,400 in 1883, 418,000 in 1884. The raising of the tax in 1886 to fr. 50 put a stop to the development of the consumption, and it was afterwards

raised in 1887 by a special tax of fr. 10 per 100 kilos. of refined sugar, applicable to sugars of every origin, even to the sugars exonerated from taxation as being *excédents*. The law of 1888 reduced the initial tax from fr. 50 to fr. 40, and raised the special tax to fr. 20. This tax being paid by the free sugars, they had no longer any exoneration except as regarded the special tax of fr. 40 per 100 kilos. of refined sugar. The law of 5th August, 1890, raised the special tax on the *excédents* to fr. 30. The freedom from taxation which sugar now enjoys is then only fr.30.

Notwithstanding these reductions, the result attained is as follows:—France, which in 1884-85 produced (in refined sugar) 307,000 tons, in 1897-98 produced 821,200 tons, and in 1898-99, 803,100 tons. In addition to this her colonies produce 100,000 tons. She consumes 459,000 tons, she has then, in round figures, 440,000 tons left on hand to dispose of. Where?—In England, and our system ends in paying the English so that they can buy their sugar from the grocer at 2d. per lb. of 453 grammes, and have become the purveyors of the whole world for biscuits and preserves.

II.

Impose countervailing duties, and we shall only have to thank you, as will be seen by the financial results of this régime which deprives the French consumer of sugar and makes him pay as taxpayer.

Colonial Sugars.—The law of 1884 provided that sugars from French colonies, imported direct into France, should be allowed a *déchet de fabrication* of 12 per cent. for the season 1886-87; by the law of 13th July, 1886, this was raised to 24 per cent. Article 2 of this law specifies that sugar exported from French colonies to the home country should, beginning with the season 1887-88, be allowed a *déchet de fabrication* equal to the average of the *excédents de rendement* obtained by the home sugar manufacturers during the season last preceding. On arrival, only those quantities representing the *déchet de fabrication* may be landed; the remainder of the cargo must be re-exported after its presence on board has been ascertained (Art. 3, law of 1886).

. The law of May 27th, 1887, raised the tax on all sugars from fr.50 to fr. 60, leaving the special tax of 10 frs. to be still paid by the colonial sugar admitted free. The net benefit as regarded taxation on the entire *déchet* thus remained at 50 francs.

The law of 24th July, 1888, raised to fr.20 the special tax on the *déchet de fabrication coloniale* (drawback on colonial manufacture), which was once more raised by the law of 5th August, 1890, to commence with the campaign of 1890-91. By the law of 1897, the colonial sugars obtained a *détaxe de distance* of fr. 2·25 per 100 kilos. of refined in the case of the Atlantic colonies, and of fr. 2·50 for the other colonies on the quantities which came to be refined in France.

For the last two campaigns, the colonial production exported and destined for the home country was (in refined equivalent) in 1897-98, 98,695,962 kilos., and in 1898-99, 100,190,244 kilos. The rate of deduction allowed on colonial sugar was 21·61 per cent and 28 per cent. respectively. The quantities admitted with this deduction were 21,328,197 and 28,053,268 kilos. The amount of the duty remitted was 30 francs per 100 kilos. of refined; the premium per 100 kilos of refined produced was fr. 6·484 and fr. 8·40. The total premiums amounted to :—

	Premium.	Détaxe.
1897-98..	6,398,459	2,274,230
1898-99	8,415,980	2,298,034

These figures are likely to vary only slightly as long as there is no change in the legislation. We see then that the colonial sugars, with a production of 100,000 tons, cost France 10 millions of francs, or 100 francs per ton.

Under the most favourable circumstances, it is impossible to estimate the value of our colonial factories at more than 50 francs per ton of work; in reality this is quite an extreme figure, for if a new factory, constructed according to the most recent improvements, would cost from 65 to 70 francs, it must be acknowledged that the old factories, which unfortunately form the immense majority, would only be saleable at the outside on the basis of 15 to 20 francs per ton. But let us take the figure of 50 francs; the whole of our colonial factories are then worth barely 50 millions, consequently *the premiums represent at least 20 per cent. of the capital invested !*

And, wonderful to say, the premiums and the *détaxes de transport* being only allowed on sugars shipped to French ports, the whole of those from Réunion (which would find their natural market in India) and the whole of those from the French Antilles (the natural market or which would be the United States) are brought to French ports. I say "brought," because a considerable portion of these sugars, after being brought here, go to England, where the result of the countervailing duties enforced by the United States has been to make

cane sugars scarce and to increase their value in comparison with that of beet sugars. It is enough to land in France the quantity representing the amount of the premium; the remainder is re-shipped en route for England.

France thus pays annually 10 millions of francs for the sake of diverting the sugars of these colonies from their natural markets, and yet, notwithstanding these advantages, such as are granted by no other country, the colonial production has remained stationary for fifteen years; consequently, *we have expended nearly 130 millions to keep going factories that are not worth 50 millions.*

Home Production.—Applying the same mode of reasoning to the home production, we may estimate the value of the French factories at about 300 millions; they are in a position to work up about 90,000 tons of beets per day; a well-appointed factory in France may cost 50 francs per ton, but there are a number of old ones that are constantly being sold on the basis of 10 to 15 francs per ton. Taking an average of 35 francs, which is a high one, we have then 315 millions. Now, for the two last years, the amount of the premiums has been from 61 to 64 millions. With the progressive improvement in the quality of the beets (the figure will on the average not vary much) it will be even much higher for the campaign now commencing. We have then *an annual sacrifice of nearly 20 per cent. on the value of the factories, and the sums granted to the home manufacturers since 1884 mount up to the enormous total of 710 millions.*

Such are the financial results of our legislation as regards sugar. If then the English should by countervailing duties force us to abandon our system of bounties on sugar, the French taxpayer ought to say: "Thanks!"

I do not need to say that other bounty-giving countries will have to abolish them in their turn. As to our internal régime, in place of stimulating production, we shall have to find new outlets for it, and there is only one means to this end, the abolition of taxation.

The present tax is apparently 60 francs, but in reality it is 68 francs, in consequence, firstly, of the *surtaxe de raffinage*, which is 4 francs, and secondly, of the reflex action of the export-bounty on the home market. If the bounties were abolished 8 francs of this would vanish. Further, the suppression of the bounties, by saving the Treasury 75 millions, would enable the State, without loosing its purse-strings, to reduce by about 18 francs the tax of 60 francs,

bringing it down to 42 francs. It may be said with certainty that if they were to stop there, there would be secured to the Treasury a certain overplus of receipts, for it would undoubtedly profit by the tax of 42 francs on a very material increase in consumption due to the reduction of 26 francs on the tax. Now, in order to promote this consumption, and also to palliate the temporary crisis due to the suppression of the bounties, it would be good policy to take the lead and reduce the tax from 42 francs to 30 francs. At the first sight, this would be an apparent sacrifice of 50 millions, but an increased consumption of 170,000 tons of sugar, or 40 per cent. on the present consumption, would, at 30 francs, be sufficient to completely cover this. In 1880, the reduction of the tax on consumption from 73 francs to 40 francs increased the consumption by 30 per cent. in two years. Let me add that at 30 francs the tax would be about equal to the value of the article, and would still be higher than that of our German and Austrian competitors.

The above facts show us the impossibility of continuing to live under such a régime, which is fatal to the producers themselves; for the effect of all these premiums is only to over-stimulate the production, and the moment this exceeds the requirements of the consumers, no premium whatever will enable the producer to work with a profit; the question is not to artificially reduce the cost price, for the selling price would fall in an equal degree.

Consequently, even the French sugar producers ought to be glad of anything that might occur to force the legislature to modify the present system. If the English bring about another conference at Brussels, and induce the Germans and Austrians to abolish the bounties, and if France is compelled to do likewise, the French producers, consumers, and taxpayers have everything to gain. Far from regarding with apprehension the threat of "Countervailing Duties," I would say we ask for them, for they would oblige us to abandon this factitious and ruinous system which may be thus defined:—

The French taxpayer pays to the sugar producers a tax which interdicts him from consuming the sugar, the production of which he has been the means of stimulating.

Yours, &c.,

YVES GUYOT.

INDIA.

The Coming Crop.

Arrangements having lately been made for regular reports of the rice, sugar cane, and indigo crops to be sent in, the Government has just issued memoranda giving details of these questions, which are summarised by the *Indian Agriculturalist* as follows:—

"In Bengal the season has been in the main favourable for the cultivation and growth of sugar cane throughout the province, except in some of the central and eastern districts where the crop suffered from excessive rain and disease in places. The area under cane approximates to the area cultivated in 1898, but is a little smaller than the average. The figures appended represent the estimated area and proportion of yield (100 representing an average crop) for each division:—

	Acres.	Yield.
Patna	205,900	104
Chota Nagpur	140,200	98
Rajshahi	128,400	83
Dacca	122,400	94
Bhagalpur	105,200	102
Burdwan	83,900	96
Presidency	49,401	88
Chittagong	19,100	91
Orissa	13,800	96

"The area under cane extends over 868,000 acres, and the yield on this area is estimated at 96 per cent. of an average crop, the estimate for 1898 having been 90 per cent.

"In the North-West Provinces and Oudh the supply of water for irrigation was sufficient, and the crop came on well until the end of April. Excessive rain in the next two months injured the crop, especially in the eastern districts, but seasonable weather is thought likely to have improved prospects. The area under cane is now roughly estimated to be about 2 per cent. larger than in 1898 and 9 per cent. in excess of the area cultivated in 1897. The yield on this area of about a million and a quarter acres is estimated at four-fifths of the average.

"The report received from the Punjab, which relates to sixteen districts only, estimates the area sown about 6 per cent. below the area sown in 1898. The break in the rains in July affected the crop in some places, but its condition at date of report was fair to good. An

average yield was anticipated, but this anticipation is subject to arrival of rain.

"In Madras the reports refer to the ryotwari tracts, forming about two-thirds of the Presidency, and do not include the proprietary lands, forming about a third of the Presidency. The area sown, though slightly in excess of that of last year, was below the average, and the season has been, on the whole, unfavourable. The crop was reported, however, at the end of August to be in fair to good condition, and prospects have improved with the recent rain."

It is within our knowledge that efforts are being made to bring the sugar refining and manufacturing industry of India more abreast of modern methods, and with the countervailing duties now existing there is every probability of the Indian manufacturers being able to improve their position, though for a time a certain amount of European beet sugar will continue to be imported, notwithstanding the duties, owing to the low price of the German and Austrian product, and its undoubtedly good quality.

CONSUMPTION OF SUGAR PER HEAD IN EUROPE AND THE UNITED STATES IN 1897-98.

The following are the quantities according to Mr. Licht, reduced to lbs. avoirdupois:—

	Lbs. per head.		Lbs. per head
Austria	17·8	Portugal	14·2
Belgium	23·0	Roumania	7·2
Bulgaria	5·5	Russia	12·6
Denmark	48·7	Servia	4·7
France	31·0	Spain	8·0
Germany	30·2	Sweden and Norway	40·6
Great Britain	91·1	Switzerland	52·0
Greece	6·2	Turkey	7·0
Holland	34·3	United States	59·2
Italy	6·3		

The British Consul at San Francisco says that the drought of this season and the uncertainty as to the policy which the United States will adopt in connection with the newly acquired possessions is causing a stoppage of further investments in beet industry in California.

COUNTERVAILING DUTIES IN THE UNITED STATES.

A Great Benefit to West India Producers.

The third Ordinary General Meeting of the New Colonial Company, Ltd. was held in London on the 2nd November, Sir Nevile Lubbock, K.C.M.G., presiding. In proposing the adoption of the Report and Balance Sheet, made up to 30th June, 1899, the Chairman made the following remarks, which we commend to our readers, who will remember the correspondence which took place at the end of last year between Sir N. Lubbock and the *Deutsche Zuckerindustrie*, respecting the effect of the American Countervailing Duties, translations of which we gave in our issues for November and December, 1898, and January and February, 1899. We reproduce these remarks because we consider that the greater part of Sir N. Lubbock's views have been fully borne out by the facts now before us, and by the diminution of the imports of bounty-fed sugar into the United States.

"As regards the price, we have realised for our sugar about 30s. a ton more this year than we did the previous year, and I want just to say a word about that price, because our accounts are constantly alluded to by Mr. Labouchere, in *Truth*, as an evidence of the fact that cane-sugar growers have no good reason to complain of the bounties given by European Governments. What Mr. Labouchere fails to see is this: that at the present moment, thanks to the United States, we are not suffering from the bounties granted by Foreign Governments. We are independent of the British market; we send our sugar to the United States, and there our cane sugar is put upon an equality with the beetroot sugar, which comes from the bounty-giving European countries. That is what we claim ought to be done by the British Government. So far, the British Government refuses to put the sugar from its own colonies on the same footing as beet-sugar. Thanks to the United States, we are on that footing at the present moment in their market, hence we have made fair profits, and I think that this is evidence that if bounties were done away with, and, if at any time in the future, we should, by misfortune, lose the United States market, we could compete in this market with beetroot sugar on equal terms, and make reasonable and fair profits."

According to the *Hacendado Mexicano* the total annual production of sugar of all kinds in Mexico does not exceed 80,000 tons. Of this about 2,000 tons are exported.

Correspondence.

THE MOTH-BORER.

In reading the report, in your September number, of the Agricultural Conference held at Barbados in January, I was much struck by the fact that Mr. Bovell in his recommendations as to the best means of dealing with the moth-borer, makes no mention of the necessity of searching for and destroying the deposits of eggs made by the moth. When I mention that on one of our estates here, containing about 120 acres of cane, nearly 15,000 deposits of eggs were found and destroyed during the months of June and July, each deposit containing from 300 to nearly 1,000 eggs (I have personally counted about 790 in one), the importance of doing this will be recognised. The deposits may be made in a different way in the West India Islands, and I confess that during a long residence in Guiana I never saw one, although I have cut out and killed hundreds of the caterpillars; here they are usually made on the green leaves of the cane and maize. No particular part of the leaf seems to be chosen, but, as a rule, they are placed well down towards the joint, particularly when the cane is high. The principal months are June and September. Here the borer is also said to prefer maize to cane, and when cane was grown by small farmers they were in the habit of sowing a few grains of maize in spots of cane that were known to be frequented year after year, and, when these got full of borer, cutting them out. There is no doubt it is extremely fond of maize, and I have taken out and killed as many as 37 from one stalk.

Whether it is from the beautiful equability of the climate and the sparse rainfall or some other ill-defined cause, all fruits in this island (except, perhaps, the banana) and indeed all plants are infested with caterpillars of one sort or another. Cane and maize have the moth-borer, and you have a continual fight with it if you wish to secure a crop of either. Some years, of course, are worse than others, but it is always with us. It is no uncommon thing to see a field of canes—which has been cut on a wet day, some of the trash and rotten ends having got pressed into the soil by the labourers' feet—show "dead-hearts" in every stool, and these have to be cut out and removed, and also the rotten ends turned up by the plough, four or five times before you can get the cane established. A gang of women and girls has to be kept at this work continually for ten months out of the twelve; latterly, when the cane gets very high, stripping carefully all the trash when they come to an infected spot, carrying it out and burning it. I do not think anything like it is to be seen in any of the West Indies, certainly not in any part of Guiana. Yet, with care, good crops are produced.

DUGALD MCPHAIL.

Teneriffe, October 28th, 1899.

IMPORTS AND EXPORTS OF SUGAR (UNITED KINGDOM).

To end of October, 1898 and 1899.

IMPORTS.

Raw Sugars.	Quantities.		Values.	
	1898.	1899.	1898.	1899.
	Cwts.	Cwts.	£	£
Germany	4,809,875	4,366,519	2,180,298	2,209,920
Holland	244,155	331,959	104,435	154,719
Belgium	915,367	1,251,297	413,367	615,668
France	1,915,052	1,282,488	962,462	724,568
Java	210,185	133,932	110,715	78,172
Philippine Islands	884,880	366,149	393,349	169,502
Cuba and Porto Rico	14,380	1,320	8,108	1,000
Peru	871,318	292,809	439,004	165,513
Brazil	425,057	55,750	201,828	28,954
Mauritius	30,010	124,980	14,677	59,203
British East Indies	390,510	551,853	169,020	278,832
British W. Indies, British Guiana, & Brit. Honduras	756,853	710,995	457,248	526,471
Other Countries	709,043	969,038	339,997	543,618
Total Raw Sugars	12,176,685	10,439,089	5,794,508	5,556,140
Refined Sugars.				
Germany	8,719,115	9,281,603	5,300,140	5,801,287
Holland	1,905,174	1,795,540	1,228,109	1,187,855
Belgium	360,619	329,930	227,611	213,026
France	2,047,758	2,259,493	1,253,531	1,419,126
United States	7,742	7,948	8,422	8,806
Other Countries	37,478	35,981	22,173	23,323
Total Refined Sugars	13,077,886	13,710,495	8,039,986	8,653,423
Molasses	1,010,837	1,290,909	258,555	312,560
Total Imports	26,265,408	25,440,493	14,093,049	14,522,123

EXPORTS.

British Refined Sugars.	Cwts.	Cwts.	£	£
Sweden and Norway	85,850	65,140	50,979	40,784
Denmark	104,919	137,732	53,664	79,849
Holland	94,273	89,849	53,322	56,987
Belgium	15,103	11,218	8,606	7,126
Portugal, Azores, &c.	64,972	61,386	35,136	36,326
Italy	31,620	16,006	16,900	9,581
Other Countries	190,310	148,992	110,657	93,152
	587,047	530,323	329,264	323,805
Foreign & Colonial Sugars.				
Refined and Candy	152,595	132,941	94,337	87,450
Unrefined	319,318	202,315	175,676	123,240
Molasses	244,819	84,962	74,604	27,859
Total Exports	1,303,779	950,541	673,881	562,354

UNITED STATES.

(Willett & Gray, &c.)

(Tons of 2,240 lbs.)	1899. Tons.		1898. Tons.
Total Receipts, 1st Jan. to 16th Nov. ..	1,590,111	..	1,197,420
Receipts of Refined ,, ,, ,, ..	1,709	..	24,588
Deliveries ,, ,, ,, ..	1,592,025	..	1,258,313
Consumption (4 Ports, Exports deducted) since 1st January	1,493,388	..	1,312,430
Importers' Stocks (4 Ports) Nov. 15th ..	3,557	..	8,823
TotalStocks, November 22nd	192,000	..	108,000
Stocks in Cuban, November 22nd	12,000	..	22,900
	1898.		1897.
Total Consumption for twelve months ..	2,047,344	..	2,071,413

CUBA.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, 1898 AND 1899.

(Tons of 2,240lbs.)	1898. Tons.		1899. Tons.
Exports	221,195	..	289,511
Stocks	41,295	..	15,174
	262,490		304,685
Local Consumption (nine months)	36,600	..	28,600
	299,090		333,285
Stocks on the 1st January (old crop)	1,515	..	4,336
Receipts at Ports up to 30th Sept... ..	297,575	..	328,949

JOAQUIN GUMA.

UNITED KINGDOM.

STATEMENT OF TEN MONTHS' IMPORTS, EXPORTS, AND CONSUMPTION FOR THREE YEARS.

	1899. Tons.		1898. Tons.		1897. Tons.
Stock, 1st January	76,930	..	90,030	..	139,623
Imports, Raw Sugar, Jan. 1st to Oct. 31st.	521,954	..	608,834	..	527,588
,, Refined, Jan. 1st to Oct. 31st ..	685,525	..	653,894	..	629,702
,, Molasses, Jan. 1st to Oct. 31st ..	64,545	..	50,542	..	51,368
	1,348,954		1,403,300		1,348,281
Stock, in 4 chief Ports, Oct. 31st	41,000	..	79,000	..	62,000
	1,307,954		1,324,300		1,286,281
Exports (Foreign, and British Refined) ..	47,527	..	65,188	..	74,415
Apparent Consumption for Ten months..	1,260,427		1,259,112		1,211,866

STOCKS OF SUGAR IN EUROPE AT UNEVEN DATES, NOVEMBER 1ST TO 22ND, COMPARED WITH PREVIOUS YEARS.

IN THOUSANDS OF TONS, TO THE NEAREST THOUSAND.

Great Britain.	Germany including Hamburg.	France.	Austria.	Holland and Belgium.	TOTAL 1899.
42	501	380	228	57	1208

	1898.	1897.	1896.	1895.
Totals	1236 ..	1190 ..	1419 ..	1429

TWELVE MONTHS' CONSUMPTION OF SUGAR IN EUROPE FOR THREE YEARS, ENDING OCTOBER 31ST, IN THOUSANDS OF TONS.

Great Britain.	Germany	France.	Austria.	Holland, Belgium, &c.	Total 1898-99.	Total 1897-98.	Total 1896-97.
1647	771	588	374	443	3823	3687	3748

ESTIMATED CROP OF BEETROOT SUGAR ON THE CONTINENT OF EUROPE FOR THE CURRENT CAMPAIGN, COMPARED WITH THE ACTUAL CROP OF THE THREE PREVIOUS CAMPAIGNS.

(From Licht's Monthly Circular.)

	1899-1900. Tons.	1898-99. Tons.	1897-98. Tons.	1896-97. Tons.
Germany	1,800,000 ..	1,721,718 ..	1,852,857 ..	1,836,536
Austria	1,100,000 ..	1,051,290 ..	831,667 ..	934,007
France	950,000 ..	830,132 ..	821,235 ..	752,081
Russia	885,000 ..	790,000 ..	738,715 ..	728,667
Belgium........	275,000 ..	235,000 ..	265,397 ..	288,009
Holland........	170,000 ..	149,763 ..	125,658 ..	174,206
Other Countries..	220,000 ..	170,000 ..	196,245 ..	202,990
	5,400,000	4,947,903	4,831,774	4,916,586

Mr. Licht has now raised his estimate for the current crop by 100,000 tons, which agrees with the opinions generally held by statisticians. Figures for individual countries may be considerably modified later on.

STATE AND PROSPECTS OF THE ENGLISH SUGAR MARKET.

We have again to report an uninteresting month both as regards movement of prices, and any special feature that might affect the future. Notwithstanding the comparatively low range of quotations, the market is inactive, buyers indifferent, and the general want of confidence which has of late been so markedly observable, still prevails. Our anticipation that the excess of the 1899-1900 beet sugar production over that of the past season would prove to be greater than that estimated at the end of October, has been verified, and this excess may possibly eventually reach 600,000 tons. It is noteworthy that, in spite of the readiness of some factories to sell the new crop of 1900 (which means twelve months ahead) at prices very little above present rates, few purchasers are found, and the deduction from this fact is that we must not look for any great change in values for some time to come. Meanwhile, the general quietness has resulted in a further slow but progressive decline, which, however, does not amount to more than 3d. per cwt.

Business in cane sugars very limited owing to short supplies; West Indian sorts find good markets at fair prices.

The following quotations are in all cases for prompt delivery :—

			Last Month.
Porto Rico, fair to good Refining	10/0 to 10/3	against	10/0 to 10/6
Cuba Centrifugals, 97% polarization	11/3	,,	11/3 to 11/6
Java, No. 14 to 15 D.S.	11/9	,,	11/9
British West India, fair brown	9/6 to 9/9	,,	10/0
Bahia, low to middling brown	9/6	,,	9/9
,, Nos. 8 and 9..	10/0	,,	10/0
Pernams, regular to superior Americanos.	9/0	,,	9/9
Madras Cane Jaggery	9/3 to 9/6	,,	9/9
Manila Taals	8/9 to 9/0	,,	9/0

French Crystals, No. 3, f.o.b.	10/1½	,,	10/1½
Russian Crystals, c.i.f..	10/6 to 10/9	,,	10/9 to 11/0
German granulated, f.o.b.	10/8½	,,	11/1½
Tate's Cubes..	15/9	,,	15/9
Beet, German and Austrian, 88%, f.o.b. ..	9/0	,,	9/1½

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